

THAILAND MODERNIZATION CNS/ATM SYSTEM PROJECT



Volume-II: Technical Terms of Reference

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AERONAUTICAL RADIO OF THAILAND

BANGKOK, THAILAND

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PART-1: SCOPE OF PROJECT

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INTRODUCTION

Volume-II contains technical specifications requirement and necessary information for provision of system, support services and implementation plan for TMCS. Volume-II is divided in to three parts where each part describes expectation and requirements for TMCS in different dimension. The requirement will be proposed in each part and each requirement will be assigned with degree of mandatory which specifies with [E] for Essential specifications requirement and [D] for Desirable specifications requirement.

The overview of each parts of Volume-II are as follows:

PART-1: SCOPE OF PROJECT

This part describes project details, project information and requirements on project management. Tenderers shall make an understanding of information and provide a complete response with form and details as specified in project schedule requirements.

This part consists of three (3) sections described below:

Section-A contains guideline information for project schedule of TMCS. The information includes, for examples, implementation plan, project management plan.

Section-B specifies all relevant issues related to project schedule requirements of TMCS for tenderers to propose their schedule, milestone and details of them using guideline information from Section-B.

Section-C contains appendix for tenderer to submit their response.

PART-2: SCOPE OF SPECIFICATIONS

This part is divided into 2 parts. The first part describes concept, minimum requirements, and submittal requirements for main operational system, contingency system and training system which is necessary for Tenderers to engage the Tender. The Tenderers should include description, product brochures, cut sheets, technical manuals and other information in order to support the proposed system. The second part provides format for Tenderers to submit their response on organization information and certification.

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PART-3: SUPPORT AND AFTER SALE SERVICE

This part consists of requirements on supports and after sale services such as Training, Documentation, and Spare Part that the Tenderer will provide to complete the Project and enable sustainable operability of TMCS through to the end of system lifecycle.

Tenderer is requested to respond each requirement with full detail where a response such as "yes, understand, comply, response and response with this or similar phases" is not an acceptable and will be considered unresponsive which will affect the evaluation score of Tenderer's Tender.

SECTION A Scope of Project**1 Project Background**

With the present aging air traffic management systems located at Tung Mahamek, Chiang Mai, Hat Yai, Phuket, Phisanulok and Hua Hin and the expected growth of air traffic of more than 200 percent within the Bangkok FIR in the next ten years, AEROTHAI has incorporated a plan to replace all existing systems in those locations. The project for modernization of Thailand CNS/ATM System (TMCS Project) has been established with a purpose to support all aspects of Air Space Management (ASM), Air Traffic Services (ATS) and Air Traffic Flow Management (ATFM) operations in Thailand's airspace. Therefore, the Tender Document has been issued to invite firms for a provision of Secondary Surveillance System Automation named as Thailand Modernization CNS/ATM System (TMCS). The TMCS relates to surveillance system with a role to collate data from surveillance sensors, flight data and other flight information sources in order to generate air traffic information for AEROTHAI's operators.

2 Project Objective

The broad objectives of the TMCS Project are as follows:

- a) Improve an efficiency of air traffic automation;
- b) Handle the expected air traffic growth in BKK FIR for the next ten years while maintaining a high level of safety;
- c) Reduce workload and improving cost-effective services;
- d) Enhance the flexibility and the versatility of air traffic control operations;
- e) Improve ATS efficiency;

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3 Project Goal

The goals of TMCS Project are as follows:

- a) The TMCS will be available within **October 2014** ;
- b) The Contingency/Training (CON/TRA) System will be installed prior to the other component and will be available for training within **August 2013** ;
- c) For training purpose, The Computer Based Training (CBT) software will be available prior to the start of the training;
- d) Besides CON/TRA System, Nationwide Air Traffic Management System (NAS) will be implemented in the first priority;
- e) ATC and Technical Training course schedule will be synchronized with the Installation plan of CON/TRA and Main Operation System (MOP). The training will be completed prior to the Project Completion date at least sixty (60) days;
- f) The Acceptance process of TMCS will include, at minimum, Factory Acceptance Test (FAT), Training Function Test (TFT), Infrastructure Test (IFT), Functional Test (FUT), Integration Test (ITT) and System Continuity Test (SCT) which are specified in Clause 19: INSPECTIONS AND ACCEPTANCE OF GOODS of Tender Document, Volume I Part II Section-C, Condition of Contract.
- g) FUT is used for testing all of the equipment and functions of TMCS for each site after system installation at each site is completed;
- h) After system installation process and FUT at all sites are completed and satisfactory, ITT will be performed to verify the harmonization and integration of all systems in TMCS;
- i) SCT is the process to ensure the reliability, availability and maintainability of TMCS. The SCT duration is, at minimum, 90 days, and will be conducted after the ITT is completed and satisfactory.

4 Implementation Plan

A draft comprehensive TMCS Project implementation and deployment plan from kick off meeting until the final acceptance of the TMCS will be detailed but not limited to as follows:

- a) Outline of work at each site.
- b) System Configuration schedule: the number of proposed system design workshops, schedule and agendas for each workshop.

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- c) Any downtime/cut over time.
- d) Installation.
- e) Testing procedures and schedules.
- f) Project Completion date.
- g) Training plan including available of CON/TRA and all courses provided in Training of Part 3, Support and After Sale Service.
- h) Testing and activation plan of TMCS including System Functionality, etc.
- i) A Work Breakdown Structure, showing the work packages, responsibilities, and expected duration. Each work package will be described with the input needed and expected deliverables.
- j) Key risks and jeopardize to satisfactory project progress and how these will be managed.
- k) Methods to manage and control the work performed under the project.
- l) Method used to monitor internal communication and reporting.
- m) Methods and procedures to manage Quality Control.

5 Project Meeting

It is necessary for AEROTHAI to have meetings with Seller in every phases of project implementation in order to ensure the project will achieve the goal. The meetings will provide the Seller opportunities to update implementation progress, prevent any foreseen problems, and review the project plan. The Tenderers will ensure that the proposed schedule and implementation plan will include but not limited to the project meeting activities as follows:

- a) On-Site Kick-Off Meeting: The Seller will conduct an on-site Kick-Off meeting at AEROTHAI head office in Bangkok, Thailand and have the Seller's Project Manager and Project Engineer attend such meeting. The meeting date will be set in relation to the contract signing date. The Seller will have the opportunity to understand the working environment, meet key personnel involved in the project, present their proposed project implementation plan and schedule and review the project schedule.
- b) System Design Review (SDR) Workshop: The Seller will conduct a SDR Workshop at AEROTHAI head office in Bangkok, Thailand and having Seller's Project Manager and Project Engineer attend such workshop. The convened date will be set according to the latest reviewed version of Project Schedule. The SDR Workshop will provide the Seller the opportunity to gather necessary information and understand user expectations from system engineer and supervisor of each ATC unit in order to ensure the design will achieve the requirement. The workshop will be conducted until both parties accept final information for system development.

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- c) Periodic Project Review Meeting: The Seller's Project Manager will meet with the AEROTHAI's project coordinator for periodic project review meetings during implementation to define the requirements for system readiness, implementation, testing and documentations. Note that the Project Coordinator will require the last updated implementation and testing plan agenda in seven (7) days prior the meeting.
- d) System Startup Meeting and System Cutover Meeting: The Seller's Project Manager will attend the startup of new system and be on-site with the implementation team to assist the Cutover system.
- e) Monthly Conference Calls: The Seller's Project Manager will host monthly conference calls with project key personnel during the design and implementation of the new system to update AEROTHAI on the progress, system implementation plan, development, testing and the project schedule.
- f) On-Site Project Closing Meeting: The Seller will conduct after the completion of system commissioning an on-site Project Closing Meeting at AEROTHAI head office in Bangkok, Thailand and having Seller's Project Manager and Project Engineer attend such meeting. The Seller will have an opportunity to summarize the activities, assist and recommend necessary issues which will be beneficial to AEROTHAI service, pass on the final documents and provision items to AEROTHAI.

6 Cutover plan

The transition from a current system into TMCS is called cutover. The detailed process that leads towards its successful implementation is known as cutover planning. The main objective of a cutover plan is to minimize disruption.

The purpose of this task is to plan system cutover activities in the appropriate sequence, to ensure that preparatory steps are complete and that the right people resources are available when required. The cutover plan covers activities for setting up and initializing the system environment.

It is important to keep in mind that as cutovers are not identical some new steps may need to be included in order to deal with unique characteristics from AEROTHAI services.

7 Quality Management Plan

Quality must always be planned into a project in order to prevent unnecessary rework, waste, cost, and time. Quality should also be considered from both a product and process perspective. The organization may already have a standardized approach to quality, however, whether it is standard or not, the approach must be defined and communicated to all project stakeholders.

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8 Project Management Plan

The TMCS Project implementation is complex and the success depends on the role of Seller. Hence, Tenderer will design and implement a comprehensive and effective project planning and management methodology together with efficient & reliable tools. The Seller will commence the project management at the start of the Contract signing date and shall continue till the completion of the project.

The project management plan must also describe the execution, management and control of the project. This information can be provided by referencing other documents that will be produced. The details of project plan are as follow:

- a) The Tenderer will ensure that a full detailed project plan and management will outlines the timeline, milestone and list of deliverables during the course of the project.
- b) The Tenderer will put in place a time schedule and phases to complete the required tasks such as analysis, design, delivery, tests, commissioning and project closing. The detail of reports to be produced at each phase of the schedule will be defined. Proposal without a time schedule shall affect the Tenderer's evaluation score.
- c) All deliverables and documents will be delivered at the end of each phase will be defined according to format in Appendix-1 of this PART.

9 Risk management plan

The risk management plan should propose applicable and effective controls for managing the risks. A good risk management plan should contain a schedule for control implementation and responsible persons for those actions.

The stage immediately after completion of the risk assessment phase consists of preparing a Risk Treatment Plan, which should document the decisions about how each of the identified risks should be handled. Mitigation of risks often means selection of security controls, which should be documented in a Statement of Applicability, which identifies which particular control objectives and controls from the standard have been selected.

10 Project Team

One of the important factors that would determine the success of the TMCS Project implementation is the continuous availability of domain experts to the implementation team. Tenderer will put together a team of domain experts with a minimum of 5 years of experience in the air traffic management system who will work on this project.

The Tenderer will provide evidence of Project Team members on participation in previous projects in the same domain and for the same services; such evidence must cover at least three previous projects.

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Mandatory information tables to be filled by the Tenderer are presented in Appendix-2 of this PART.

SECTION B Project Schedule Requirements

The Tenderer shall propose a Project Schedule which takes the requirements outlined in item 3 - 10 above into account. The Tenderer shall propose and detail the following requirements

- | | | |
|---------|--|-----|
| PRS-001 | The Tenderer shall propose the implementation plan including the list of all deliverables that will be provided for each activity. | [D] |
| PRS-002 | The Tenderer shall propose and detail project meeting plan including the list of all deliverables that will be submitted for each meeting. | [D] |
| PRS-003 | The Tenderer shall propose and detail Cutover plan and process including the list of all deliverables that will be submitted at the end of each activity. | [D] |
| PRS-004 | The Tenderer shall propose and detail Cutover expert team and their roles to support in the pre and the pose step of the cutover time. | [D] |
| PRS-005 | The Tenderer shall propose and detail Quality Management plan and process including the list of all deliverables that will be submitted for each activity. | [D] |
| PRS-006 | The Tenderer shall propose and detail Project Management methodology including the efficient and reliable tools for implement the project. | [D] |
| PRS-007 | The Tenderer shall propose full detailed Project Management plan which outlines the timeline, milestone and list of deliverables to be submitted during the course of the project. | [D] |
| PRS-008 | The Tenderer shall submit their response in the mandatory information tables in Appendix-1 of this PART. | [D] |
| PRS-009 | The Tenderer shall propose and detail Risk Management plan including the list of all deliverables that will be submitted for each activity. | [D] |
| PRS-010 | The Tenderer shall propose and detail Risk Treatment plan including the list of all deliverables that will be submitted for each activity. | [D] |

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PRS-011	The Tenderer shall propose and detail Quality Management plan including the list of all deliverables that will be submitted at the end of each activity.	[D]
PRS-012	The Tenderer shall propose and detail Installation plan and process including the list of all deliverables that will be submitted at the end of each activity.	[D]
PRS-013	The Tenderer shall propose and detail Training plan including the list of all deliverables that will be submitted at the end of each activity.	[D]
PRS-014	The Tenderer shall propose and detail System testing plan and process including the list of all deliverables after the end of each activity.	[D]
PRS-015	The Tenderer shall propose and detail project expert team and submit their response in mandatory information tables in Appendix-2 of this PART.	[D]

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SECTION C Appendices**Appendix-1****PROJECT PLAN**

(Details shall be detailed per phase)

Expected time frame for this project is() days	
Phase of project	Deliverable
Example: Implementation Plan Review	Example: Kick-off Report, Work (Implementation) Plan, and Time Line

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Appendix-2**TEAM PROFILE**

(Details shall be detailed per person)

Items	Descriptions	Note
Name		
Current Designation / Job Title		
Current job responsibilities		
Proposed Role in the Project		
Proposed Responsibilities in the Project		
Academic Qualifications: <ul style="list-style-type: none"> Degree Year of graduation Specialization (if any) 		
Professional Certifications (if any)		
Number of years with the current company		
Summary of the Professional / Domain Experience		
Number of complete project implementations carried out		
Past assignment details (For each assignment provide details regarding name of organizations worked for, designation, responsibilities)		
Last project experience (provide only relevant projects) <ul style="list-style-type: none"> Project name Client Key project features in brief Location of the project Designation Role 		

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<ul style="list-style-type: none">• Responsibilities and activities• Project Schedule		
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PART 2 : SCOPE OF SPECIFICATIONS

2.1 SCOPE OF TECHNICAL SPECIFICATIONS

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List of Abbreviations

Abbreviation	FullName
A01	New Operation Building, FL02
A02	CON/TRA Building, FL01
A03	Operation Building (ATC Complex), FL05
A04	CON/TRA Building, FL03
A05	Operation Building, FL02
A06	Operation Building, FL02
A07	Operation Building, FL01
A08	ADM Building, FL02
A09	Operation Building, FL01
A10	ADM Building, FL03
A11	Operation Building, FL05
A12	AFL Building, FL01
A13	Operation Building, FL02
A14	Operation Building, FL06
A15	Operation Building, FL05
A16	Operation Building, FL03
A17	Operation Building, FL06
ACC	Area Control Centre
ACID	Aircraft Identification
ADEXP	ATS Data Exchange Presentation
ADF	Air Defense Operator
ADS-B	Automatic Dependent Surveillance - Broadcast
AFL	Air Field Lighting System
AFTN	Aeronautical Fixed Telecommunication Network
AGDL	Air-Ground Data Link System
AIDC	ATS Inter facility Data Communication
AIM	Aeronautical Information Management
AIMS	Airport Information Management System
AMAN	Arrival Manager
AMHS	Aeronautical Message Handling System
AO	Airport Operator
AoI	area of interest
AOM	Airspace Organization and Management function

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Abbreviation	FullName
AoR	Area(s) of responsibility
AOs	Airport Operators
APM	Approach Path Monitoring
APP	Approach Control
APP IBS	APP Independent Backup System
APPS	Approach Control Systems (BAPP, CMA, HTY, PUT, PSL, HHN)
APW	Area Proximity Warning
ARO	Aeronautical Reporting Office
ASD	Air Situation Display
ASM	Airspace Manager
A-SMGCS	Advance Surface Movement Guidance and Control Systems
ATA	Actual Time of Arrival
ATC	Air Traffic Controller
ATD	Actual Time of Departure
ATFM	Air Traffic Flow Management
ATFMU	Air Traffic Flow Management Unit
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
AUP	Airspace Use Plans
BACC	Bangkok Area Control Centre
BADA	EUROCONTROL BAse of Aircraft Data
BAO	Bay Allocation Operator
BAPC	Bangkok Approach Control Centre
BAPP	Bangkok Approach Control
CATIS	Computerized Automatic Terminal Information System
CBT	Computer Based Training
CCMS	Central CNS/ATM Monitoring System
CDC	Clearance Delivery
CDM	Collaboration Decision Making
CDR's	Conditional Routes
CIFDPS	Central Initial Flight Data Processing System
CMA	Chiangmai Airport
CMA APC	Chiangmai Approach Control Centre
CMAC	Civil Military Airspace Coordinator

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Abbreviation	FullName
CMS	Control and Monitoring System
CMWS	Control and Monitoring Workstation
COF	Control Feature
CON	Contingency
CON/TRA	Contingency/Training System
COR	Coordinator
COTS	commercial off-the-shelf
CPDLC	Controller Pilot Data Link Communication
CRAM	Conditional Route Availability Messages
CTA	Control Time of Arrival
CWS	Controller Workstation
DA	Direct Access
DAA	Data Analysis
DAWS	Data Analysis Workstation
DCB	Demand and Capacity Balancing
DDN	digital Data Network
DMA	Don Muang Airport
DMAN	Departure Manager
DSM	Data Set Management
DSO	Data Set Operator
DSWS	Data Set Workstation
DVR	Digital Voice Recorder & Replay System
EC	Executive Controller
EO	Evaluation Operator
EOBT	Estimated Off-Block Time
EPT	Estimated Parking Time
ETA	Estimated Time of Arrival
ETOT	Estimate Take Off Time
FAO	Flight Announcement Operator
FDD	Flight Data Display
FDDWS	Flight Data Display Workstation
FDMC	Flight Data Management Center
FDO	Flight Data Operator
FDP	Flight Data Processing
FDWS	Flight Data Workstation

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Abbreviation	FullName
FIS	Flight Information Service
FISL	Flight Information Specialist
FMC	Bangkok Air Traffic Flow Management Unit Planner / Coordinator
FMM	Bangkok Air Traffic Flow Management Unit Manager
FPL	Flight Plan
FSDP	Fallback Surveillance Data Processing
F-SDPS	Fallback Surveillance Data Processing System
FTI	Free Text Insert
FUA	Flexible Use of Airspace
GDF	Guidance Feature
GND	Ground Controller
GSD	Ground Situation Display
HFDS	Human Factor Design Standard
HHN	Hua Hin Airport
HHN APC	Hua Hin Approach Control Centre
HMI	Human Machine Interface
HTY	Hat Yai Airport
HTY APC	Hat-yai Approach Control Centre
IA	Indirect Access
IBS	Independent Backup System
ID	identification
KRT	Nakhon Ratchasima Airport
LCL	Local Controller
LRU	Line Replaceable Unit
LTS	Local Tower Systems
MDF	main distribution frame
MET	Meteorological
MIB	Management Information Base
MIL	Military Tower Operator
MIT	Miles-In-Trail
MLAT	Multi Lateration Surveillance System
MONA	Monitoring Aids function
MOPS	Main Operation System
MRT	Multi Radar Tracking
MSA	Multi-Sector Area

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Abbreviation	FullName
MSAW	Minimum Safe Altitude Warning
MSDP	Main Surveillance Data Processing
M-SDPS	Main Surveillance Data Processing System
Msg.	Messages
MSP	Multi sector Planner Controller
MTBF	Mean Time Between Failures
MTCD	Medium Term Conflict Detection function
MTN	Maintenance Engineer
MTTR	Mean Time To Repair
NAS	Nationwide Air Traffic Management System
NAS IBS	Nationwide Air Traffic Management Independent Backup System
NMS	Network Management System
NMWS	Network Management Workstation
OFBL	Off Block
ONBL	On Block
OPS	Operational
OPSUP	Operational Supervisor
PABX	Private Automatic Branch Exchange
PC	Planner Controller
PSL	Phitsanulok Airport
PSL APC	Phitsanulok Approach Control Centre
PSP	Pseudo Pilot
PSPWS	Pseudo Pilot Workstation
PSR	Primary Surveillance Radar
PSN	Parking Stand Number
PSTN	Public Switched Telephone Network
PTT	Push-to-talk
PUT	Phuket Airport
PUT APC	Phuket Approach Control Centre
QNH	The barometric pressure
QoS	Quality of Service
RAID	Redundant Array of Independent Disks
RAM	Reliability, Availability, and Maintainability
RATFM	Regional Air Traffic Flow Management System
RATFMU	Regional Air Traffic Flow Management Unit

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Abbreviation	FullName
RDBMS	Relational Database Management System
REC	Recording
REC/REP	Recording and Replay
REP	Replay
RLIM	radio line interface module
RMON	Remote Network MONitoring
RPF	Route Planning Feature
RPLs	Repetitive Flight Plans
RTS	Remote Tower System
SBA	Suvanabhumi Airport
SDP	Surveillance Data Processing
SDPS	Surveillance Data Processing System
SFPL	System Flight Plan
SID	Standard Instrument Departure
SMC	System Monitoring & Control
SMM	System Maintenance Manual
SNMP	Simple Network Management Protocol
SPI	Special Position Indication code
SSR	Secondary Surveillance Radar
STAR	Standard Arrival Route
STCA	Short Term Conflict Alert
STS	Static Transfer Switch
SUF	Surveillance Feature
SUR	Surat Thani Airport
TA	Transition Altitude
TACTSUP	Tactical Supervisor
TBS	Time Based Spacing
T-CMS	Tower Control and Monitoring System
TCU	Technical Control Unit
T-CWS	Tower Controller Workstation
T-DSM	Tower Dataset Management
T-DSO	Tower Dataset Operator
TECH	technical staff
TECHSUP	Technical Supervisor
TED	Touch Entry Device

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Abbreviation	FullName
TED panel	Touch Entry Device Panel
TEFS	Tower Electronic Flight Strip
TEG	Traffic and Event Generator
T-EO	Tower Evaluation Officer
T-FDO	Tower Flight Data Operator
TFDP	Tower Flight Data Processing
TL	Transition Level
TLIM	telephone line interface module
TM	time management
TMA	Terminal Control Area
TMC	Training Mission Control
TMCS	Thailand Modernization CNS/ATM System
TMCWS	Training Mission Control Workstation
T-MTN	Tower Maintenance Engineer
T-NMS	Tower Network Management System
TP	Trajectory Prediction
TRA	Training
TRAs	Temporary Reserved Areas
TRN	Trainee
TRS	Time Reference System
TS	Traffic Synchronization
TSAs	Temporary Segregated Areas
TSAT	Target Start Up Approval Time
TSDP	Tower Surveillance Data Processing function
T-TACTSUP	Tower Tactical Supervisor
TTOT	target take-off time
TWR-CMS	Tower Control and Monitoring System
UBL	Ubon Ratchathani Airport
UDN	Udon Thani Airport
UPS	Uninterrupted Power Supply
UTC	Coordinated Universal Time
UUP	Updated Airspace Use Plans
VCCS	Voice Communication and Control System
VLAN	Virtual LAN
WAM	Wide Area MLAT

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Abbreviation	FullName
WAN	wide area network

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SECTION A Introduction

Thailand Modernization CNS/ATM System (TMCS) is an automation system under the modernization of Thailand Air Traffic Management (ATM) System Project. TMCS offers an efficient and flexible ATM system in order to meet expected growth in traffic and also to provide support for AEROTHAI's air traffic management.

The main objective of Volume II is to describe TMCS in technical details. This volume specifies guideline information and all requirements, both essential and desirable, to be used as a reference for implementation of TMCS. The requirements consist of TMCS' operational, functional and capacity requirements, hardware and software requirements, and services requirements for commissioning the TMCS. Each requirement statement is classified and labeled as:

- a) Essential requirement specification [E];
- b) Desirable requirement specification [D];

Section B contains guideline information for TMCS. The information includes, for examples, System Architecture, the level of Contingency and Backup, Site Information, etc. All statements within this chapter are for Tenderers' information only.

Section C specifies all relevant issues related to Provisional Requirements of TMCS for Tenderers to propose their solutions using guideline information from Section B.

Section D contains all appendixes.

Furthermore, in this document, Section B explains the full scope of TMCS while Section C and D specify the required scope of the system which Tenderers have to propose. In the future, the Tenderer-proposed system (as described following Section C and D) will be the foundation system on which AEROTHAI will be able to expand to cover the full scope as described in Section B without any software modification on the proposed system.

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SECTION B System Description

1 System Architecture

The system architecture of TMCS, including all systems situated at various sites across Thailand and their logical connections, is conceptually depicted in Figure 1. The architecture comprises forty nine (49) systems as follows:

- a) One (1) Nationwide Air Traffic Management System (NAS): NAS support the operation of BACC/ BAPC. Meanwhile, NAS will be center for nationwide flight plan database. The system will be situated at AEROTHAI Headquarter.
- b) One (1) Nationwide Air Traffic Management Independent Backup System (NAS IBS): NAS IBS will be established as the backup system for NAS in case of Disaster Situation at the NAS. The location of NAS IBS will be at AEROTHAI Headquarter.
- c) Six (6) Approach Control (APP) Systems: The APP System should support the operation of BAPP, CMA APC, HTY APC, PUT APC, PSL APC, and HHN APC.
- d) One (1) APP Independent Backup System (APP IBS): APP IBS will be the backup system for any APP System. This IBS can be configured to overcome the operation of any APP systems.
- e) Forty (40) tower systems: There are six (6) Local Tower Systems (LTS), thirty (30) Remote Tower Systems (RTS) for remote towers at airports and four (4) RTS for Military towers: The tower system supports the operation of Aerodrome Control at its corresponding airport.

Major System Component

NAS and APP System comprise two (2) major system components as follows:

1.1 Main Operation System (MOPS)

MOPS is the main system supporting controllers' operation in the TMCS environment and is capable of handling future traffic growth whilst reducing workload and improving cost-efficiency. To achieve those objectives, the MOPS must be flexible in order to utilize staff resources more efficiently, an example being the reduction of active controllers at certain times by merging areas of responsibility for positions during low traffic situations whilst getting a higher level of automated support during peak traffic scenarios.

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The MOPS consists of various systems and possesses many capabilities in order to support different operation services such as en-route control service and approach control service. For example, Data Processing System (Server), Voice Communication and Control System (VCCS), and End System (clients, printers, etc.), etc. are part of MOPS.

Data Processing System is the heart of the MOPS. The system consists of many functions such as flight data processing function, surveillance data processing function, arrival management function, departure management function, flexible use of airspace function, etc.

Communication is a vital part of the MOPS. A main VCCS, supported by a fall-back VCCS, will be incorporated along with other vital systems e.g. Digital Voice Recorder & Replay System (DVR), Time Reference System (TRS), System Monitoring & Control (SMC) etc.

1.2 Contingency/Training System (CON/TRA)

The Contingency/Training System (CON/TRA) is an integrated design solution in support of the contingency and the training mission. The CON/TRA will be able to operate in two modes: CON Mode and TRA Mode. Both modes of operation should utilize the same hardware package. The CON Mode-Software is a copy of the MOPS software and it is completely separated from the TRA Mode-Software.

By launching a specific mode, the CON Mode or the TRA Mode on the respective server pack or in dual-boot, it configures feeds and interacts with the appropriate End Systems as configured by pre-set settings. Common components for both modes of the CON/TRA are VCCS, End Systems, etc.

The CON/TRA synchronizes all information with the MOPS at all time regardless of its mode of operation. Once the contingency situation occurs, the CON/TRA will be ready for operation as quickly as possible (e.g. less than 15 minutes) regardless of its mode of operation. The CON/TRA will be designed such that maintenance engineer can perform switch-over from MOPS to CON/TRA as easy as possible. The CON/TRA connects to the MOPS within 5 Km. radius distance.

After the contingency situation passes and, the MOPS must synchronize with the CON/TRA to update the information. Once the update completes, then the MOPS is able to be utilized again.

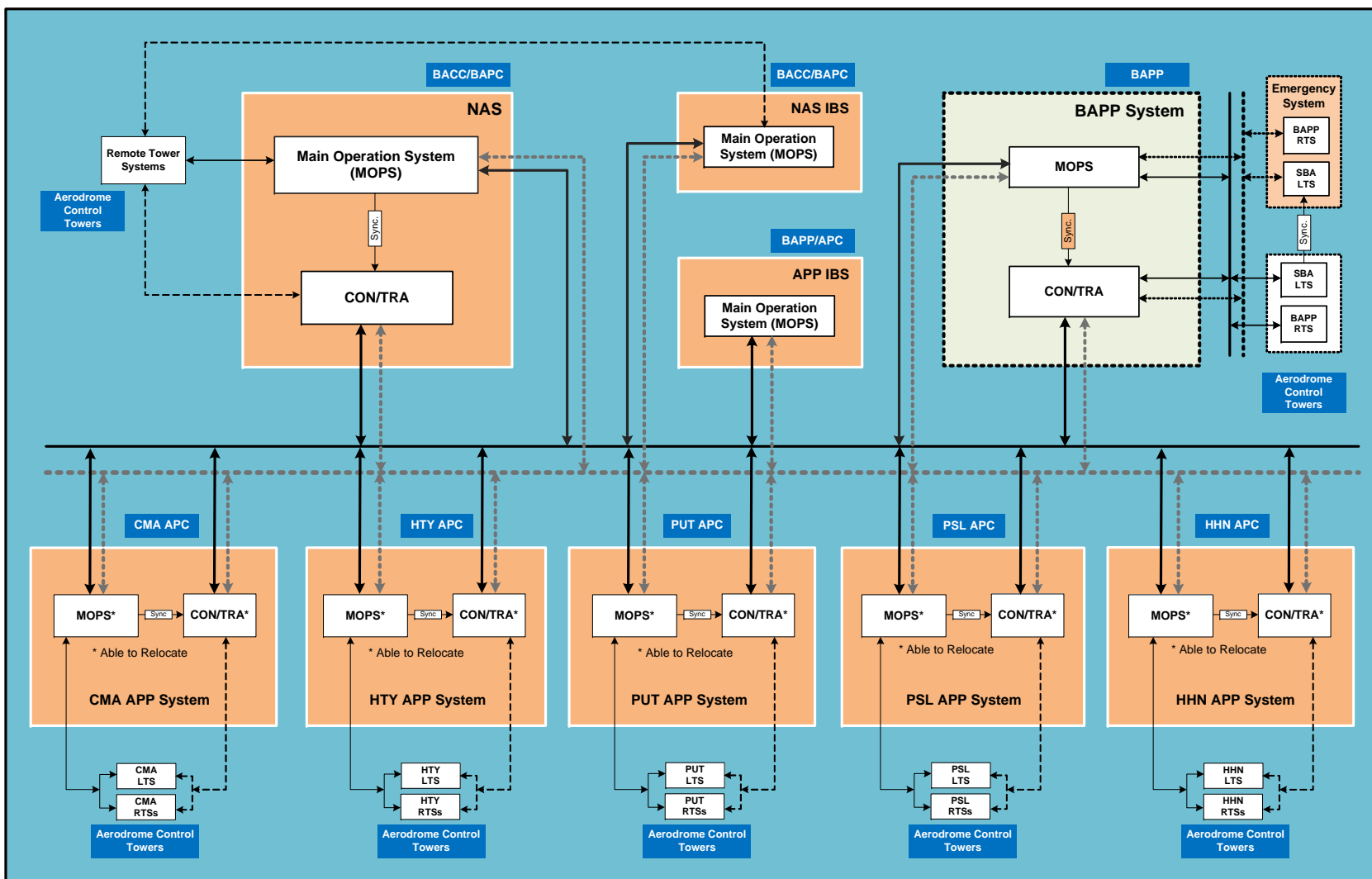


Figure 1 TMCS' System Architecture

2 The Level of Contingency and Backup

The capability of contingency and backup for TMCS is conceptualized into five (5) levels corresponding to levels of situations. Figure 2 displays the relationship between different components with regards to contingency & backup level from level-I to level-IV. The details of each level are described as follow:

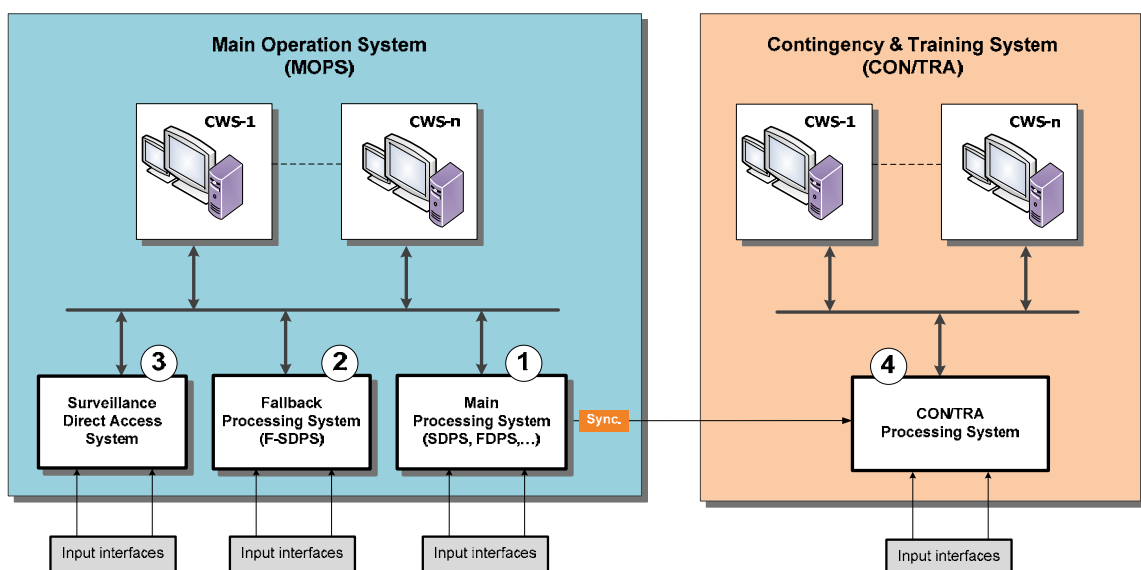


Figure 2 Concept of Contingency & Backup Level I – Level IV

2.1 Level-I : Redundancy Principles :

All servers and internal network in the system have, at minimum, been duplicated and operate simultaneously. When one server in the pair fails to function, the other server takes over immediately without any interruption to the operation of air traffic controllers.

The network is also implemented using dual redundant network equipments. This will interconnect every End System to every Server using two independent paths. Failure of one link will be automatically detected, and operation is switched over to the functioning network.

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For TMCS, all systems' servers, with the exception of CON/TRA's servers, in the scope of this project will be duplicated and operate simultaneously. Furthermore, all systems in the scope of this project will achieve the dual redundant network capability.

2.2 Level-II : Fallback Processing System:

The Fallback Processing System is another system running in parallel with the Main Processing System. It comprises, at minimum, the Fallback Surveillance Data Processing System (F-SDPS). As the name implies, the F-SDPS acts as the fallback mechanism when the Main Surveillance Data Processing System (M-SDPS) fails. Users can choose the F-SDPS at any time without interruption to their operation. Moreover, to ensure protection from software anomaly failure, F-SDPS will use different software algorithm from the M-SDPS.

For TMCS, the NAS, the NAS IBS, the APP IBS, the BAPP System, the CMA APP System, the HTY APP System, the PUT APP System, the PSL APP System, and the HHN APP System, will achieve this level-II.

2.3 Level-III : Surveillance Direct Access :

This Surveillance Direct Access supports the situation when all duplicated Surveillance Data Processing System (SDPS) fail unexpectedly. The system will be able to provide direct surveillance information. Surveillance Direct Access enables appropriate End System to display Surveillance Track information directly without utilizing Multi Radar Tracking (MRT) function of SDPS.

Surveillance Direct Access allows user to choose and display surveillance track coming from any surveillance sources at any time without interruption to their operation.

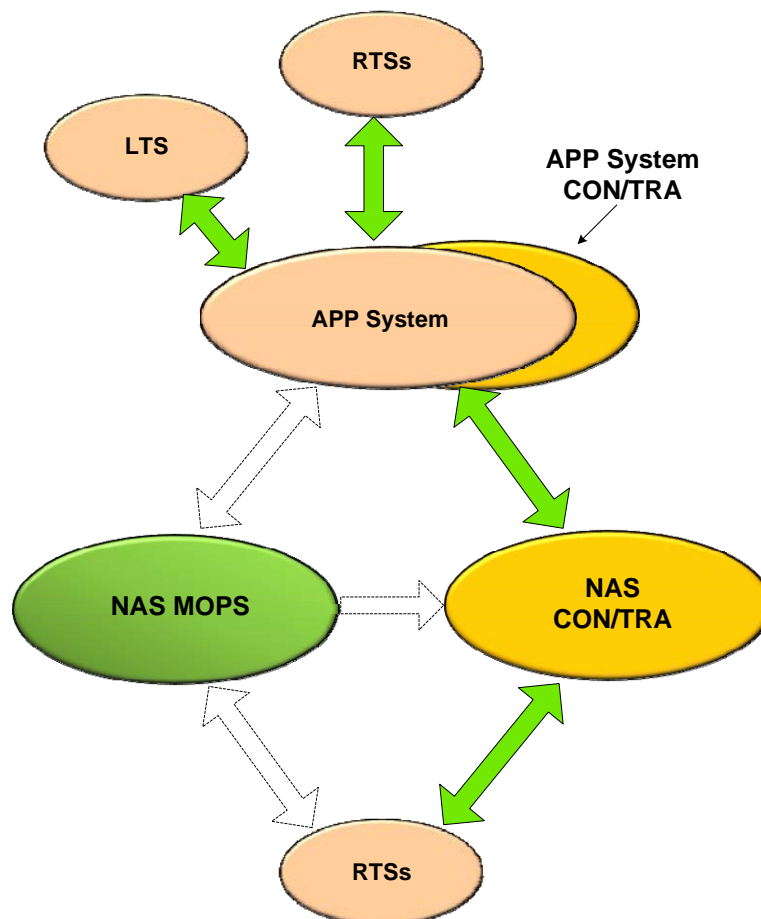
For TMCS, the NAS, the NAS IBS, the APP IBS, the BAPP System, the CMA APP System, the HTY APP System, the PUT APP System, the PSL APP System, and the HHN APP System, will achieve this level-III.

2.4 Level-IV : Contingency System:

The CON/TRA synchronizes information with the MOPS at all time. The CON/TRA in Contingency Mode (CON Mode) will operate in place of MOPS; therefore, it will have connections to all input interfaces the same as MOPS.

For example, all systems, which have been connected to the NAS MOPS e.g. 1) APP Systems and 2) Remote Tower Systems (RTS), will switch to connect to the NAS CON/TRA in CON Mode instead.

Figure 3 displays the concept of the switch-over from the NAS MOPS to NAS CON/TRA in contingency situation. The dashed arrows represent the connections between NAS MOPS and other systems (APP System and RTS). In CON Mode, the bold arrows represent connections between CON/TRA and other systems (APP System and RTS).



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Figure 3 Connections between NAS CON/TRA and other systems in Contingency Mode

For TMCS, the NAS, the BAPP System, the CMA APP System, the HTY APP System, the PUT APP System, the PSL APP System, and the HHN APP System, will achieve this level-IV.

2.5 Level-V : Independent Backup:

Normally, in the Contingency Situation of NAS, it is assumed that air traffic controllers can still operate at the AEROTHAI Headquarter. In case of Disaster Situation, it is envisaged that air traffic controllers will not be able to operate at AEROTHAI Headquarter and must be evacuated. Another Disaster Situation may imply that access to AEROTHAI Headquarter has been severely restricted and normal operations can not take place. Therefore, it is necessary to prepare another backup system for the NAS to handle Disaster Situation. This backup system is called NAS IBS and will be implemented in a remote location further away from AEROTHAI Headquarter in the future.

The same principle applies to all APP Systems, therefore, APP IBS is needed for Disaster Situation for all APP Systems. This APP IBS will be able to operate in place of any APP MOPS including BAPP MOPS, CMA APP MOPS, HTY APP MOPS, PUT APP MOPS, PSL APP MOPS and HHN APP MOPS one at a time.

Figure 4 shows connection between the NAS IBS and various related-systems in the Disaster Situation. The bold arrow lines depict connection in the Disaster Situation while the dashed arrow lines depict connection in normal situation.

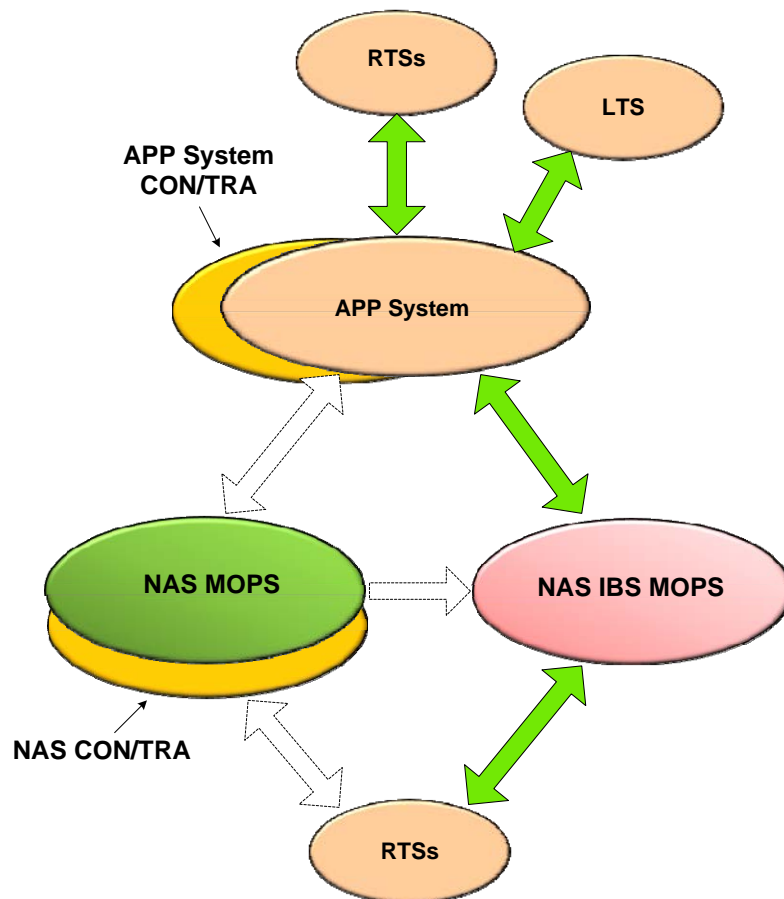


Figure 4 Connections between NAS IBS and other systems in case of Disaster Situation

The NAS IBS, should have the same hardware and software licenses to cover the quantities of Servers and network capabilities for the operation of NAS MOPS.

Since the APP IBS will operate in place of any APP Systems, it will also have enough hardware to perform as such. Therefore, in the current configuration, the APP IBS will have, at minimum, the hardware covering quantities of Servers and network capabilities at BAPP MOPS, which has the highest quantities of hardware among APP System.

The APP IBS will be able to operate in many modes to support APP system such as CMA APP Mode, HTY APP Mode, etc. All modes of operation should utilize the

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same hardware package. The software for each mode is a copy of its corresponding MOPS software such as CMA APP Mode is a copy of CMA APP MOPS.

By launching a specific mode, on the respective server pack or in multi-boot, it configures feeds and interacts with the appropriate End Systems as configured by pre-set settings.

At the present, both IBSs do not require any End System hardware. AEROTHAI can procure end system hardware and use them for both IBSs without any software modification on both systems.

In summary, for TMCS, the NAS will achieve this level-V using NAS IBS. All APP Systems will also have another IBS to achieve level-5 – using APP IBS.

3 Operational Context

This section emphasizes on the interaction within TMCS' many Operators. It also explains interaction between TMCS' operators and other related operators.

Related Operators can be categorized into two groups:

- a) Direct supporting Operators: These Operators include both AEROTHAI's internal Operators and external Operators (Air defense Units, Military Towers).
- b) Operator coordinating with TMCS but not under the scope of TMCS: These Operators need coordination mechanism with TMCS and some may require TMCS to adjust its external interface, e.g. Airport Operators (AOs), Adjacent ACCs.

Figure 5 describes the operational context of TMCS

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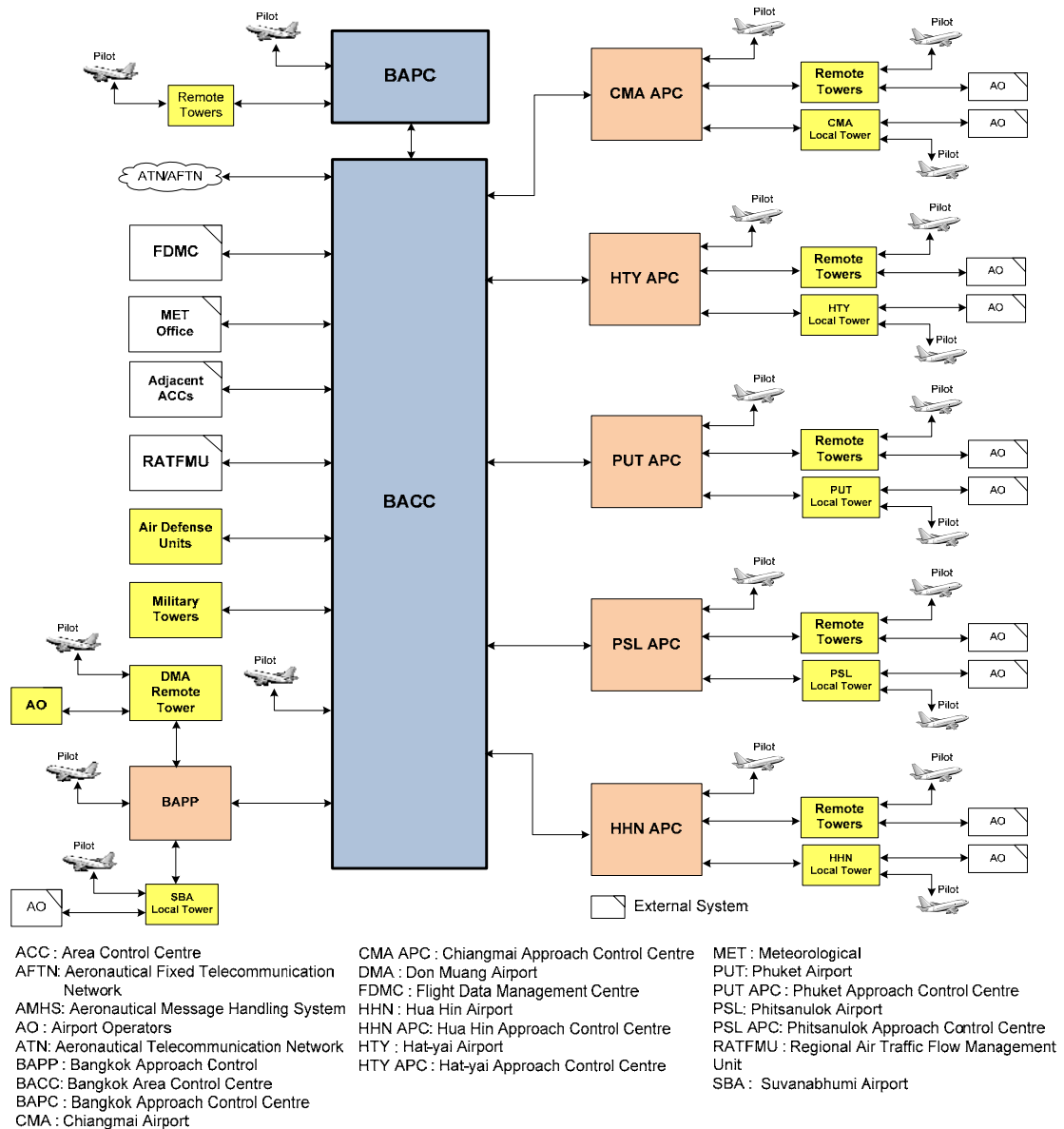


Figure 5 Operational Context of TMCS

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**3.1 Aeronautical Fixed Telecommunication Network / Aeronautical
Telecommunication Network (AFTN/ATN):**

The BACC/BAPC operation will exchange relevant information with external users using both AFTN and ATN.

3.2 Flight Data Management Centre (FDMC):

AEROTHAI has implemented the FDMC to manage the flight data received through different means such as AMHS, etc. The BACC/BAPC operation will then exchange relevant information with FDMC.

The underlying system supporting FDMC operation is Central Initial Flight Data Processing System (CIFDPS). The responsibilities of CIFDPS are as follow:

- Act as data repository for terminated FPL data and system FPL data for statistical and billing purposes.
- Act as data repository for all system track data for statistical and billing purposes.

3.3 MET Office:

The BACC/BAPC operation will coordinate with MET office to receive meteorological information/data.

3.4 Adjacent ACCs:

The BACC/BAPC operation will coordinate with Adjacent ACCs. If an Adjacent ACC possesses ATM systems, the BACC/BAPC operation should be encouraged to coordinate with the ATM systems using ground-ground data communication.

3.5 Regional Air Traffic Flow Management Unit (RATFMU):

RATFMU operates as an air traffic flow management for the BKK FIR, and in the future, RATFMU may operate as regional air traffic flow management for the Asia/Pacific region. The BACC/BAPC operation will coordinate with RATFMU to exchange flow control information such as slot allocations, slot modification, etc.

3.6 Air Defense Units:

There are three (3) air defense units within BKK FIR which associate with the BACC/BAPC operation.

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3.7 Military Towers:

There are four (4) military towers within BKK FIR which coordinates with the BACC/BAPC operation.

3.8 Bangkok Approach Control (BAPP):

BAPP provides approach control service within Bangkok control zone and Bangkok Terminal Control Area (TMA). The BAPP operators coordinate with four (4) groups of operators; BACC/BAPC, SBA Local Tower, DMA Remote Tower, and pilots.

3.9 Suvarnabhumi Airport (SBA) Local Tower :

SBA local tower is under responsibility of BAPP operation. SBA local tower operators coordinate with three (3) groups of operators; BAPP, Airport Operator (AO), and pilots.

3.10 Don Muang Airport (DMA) Remote Tower:

DMA remote tower is under responsibility of BAPP operation. DMA remote tower operators coordinate with three (3) groups of operators; BAPP, AO, and pilots.

3.11 Airport Operator (AO):

For DMA, the airport operator will coordinate with DMA RTS. AO usually sends essential information such as Flight Formality Check and Bay Allocation to DMA RTS.

3.12 Bangkok Area Control Centre (BACC):

BACC operation is responsible for the provision of en-route air traffic control and flight information services throughout the BKK FIR. BACC operators coordinate and exchanges information with various operators such as AMHS, FDMC, APCs, Adjacent ACCs, etc.

3.13 Bangkok Approach Control Centre (BAPC):

The BAPC provides approach control services within terminal control areas (TMA) and control zones of the 19 airports. BAPC operators coordinate with three (3) groups of operators; BACC, associated remote towers under BAPC responsibility, and pilots.

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3.14 Remote Towers associated with BAPC:

There are nineteen (19) remote towers under responsibility of BAPC. Remote towers operators coordinate with three (3) group of operators; BAPC, respective AO, and pilots.

3.15 Pilots connected to BACC/BAPC, BAPP, APCs, LTSs, RTSs :

BACC/BAPC, BAPP, APCs, LTSs, and RTSs operation are able to coordinate with pilots via voice communication and, where applicable, air-ground data link communication.

3.16 Chiang Mai Approach Control Centre - CMA APC:

The CMA APC provides approach control services within terminal control areas (TMA) and control zones of the 4 airports. CMA APC operators coordinate with four (4) groups of operators; BACC/BAPC, CMA local tower, associated remote towers, and pilots.

3.17 Chiang Mai Airport (CMA) Local Tower

CMA Local Tower is under responsibility of CMA APC. CMA local tower operators coordinate with three (3) groups of operators; CMA APC, AO, and pilots.

3.18 Remote Towers associated with CMA APC:

There are three (3) remote towers under responsibility of CMA APC. Remote towers operators coordinate with three (3) groups of operators; CMA APC, respective AO, and pilots.

3.19 Hat Yai Approach Control Centre - HTY APC:

The HTY APC provides approach control services within terminal control areas (TMA) and control zones of the 4 airport areas. HTY APC operators coordinate with four (4) groups of operators; BACC/BAPC, HTY local tower, associated remote towers, and pilots.

3.20 Hat Yai Airport (HTY) Local Tower:

HTY Local Tower is under responsibility of HTY APC. HTY local tower operators coordinate with three (3) groups of operators; HTY APC, AO, and pilots.

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3.21 Remote Towers associated with HTY APC:

There are three (3) Remote Towers associated with HTY APC. Remote towers operators coordinate with three (3) groups of operators; HTY APC, respective AO, and pilots.

3.22 Phuket Approach Control Center - PUT APC:

The PUT APC provides approach control services within terminal control areas (TMA) and control zones of the 3 airport areas. PUT APC operators coordinate with four (4) groups of operators; BACC/BAPC, PUT local tower, associated remote towers, and pilots.

3.23 Phuket Airport (PUT) Local Tower:

PUT Local Tower is under responsibility of PUT APC. PUT local tower operators coordinate with three (3) groups of operators; PUT APC, AO, and pilots.

3.24 Remote Towers associated with PUT APC:

There are two (2) Remote Towers associated with PUT APC. Remote towers operators coordinate with three (3) groups of operators; PUT APC, respective AO, and pilots.

3.25 Phitsanulok Approach Control Center - PSL APC:

The PSL APC provides approach control services within terminal control areas (TMA) and control zones of the 3 airport areas. PSL APC operators coordinate with four (4) groups of operators; BACC/BAPC, PSL local tower, associated remote towers, and pilots.

3.26 Phitsanulok Airport (PSL) Local Tower:

PSL Local Tower is under responsibility of PSL APC. PSL local tower operators coordinate with three (3) groups of operators; PSL APC, AO, and pilots.

3.27 Remote Towers associated with PSL APC:

There are two (2) Remote Towers associated with PSL APC. Remote towers operators coordinate with three (3) groups of operators; PSL APC, respective AO, and pilots.

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3.28 Hua Hin Approach Control Centre – HHN APP:

The HHN APP provides approach control services within terminal control areas (TMA) and control zones. HHN APP operators coordinate with three (3) groups of operators; BACC/BAPC, HHN local tower, and pilots.

3.29 Hua Hin Airport (HHN) Local Tower:

HHN Local Tower is under responsibility of HHN APC. HHN local tower operators coordinate with three (3) groups of operators; HHN APC, AO, and pilots.

4 Intersystem Connection

This section describes logical intersystem connections of NAS MOPS, APP MOPS and LTS/RTS following the operational context.

Tenderers may design their own appropriate physical connections and systems to achieve these logical connections.

4.1 Data Integrity and Security

Tenderers will offer data integrity and security against unauthorized access, intrusion and malicious computer attacks without reducing the intersystem connection capabilities. The mechanism to provide data integrity and security will include, at minimum:

- 32-bit cyclic redundancy check (CRC) to protect the integrity of all stored data;
- Permissions or access control to system, databases and applications that users and user groups are assigned for specific functions and data required to complete their duties on the ATMS;
- Data security that protects the data and applications from infection by computer virus or malicious software;
- Secure operating system that includes hardening of operating system and disabling automatic updates of operating system;
- Segregation of external data flows onto isolated networks;
- Data gateways for communication with external systems;
- Layered network security that uses routers, switches and firewalls to set up virtual network and demilitarized zone; and

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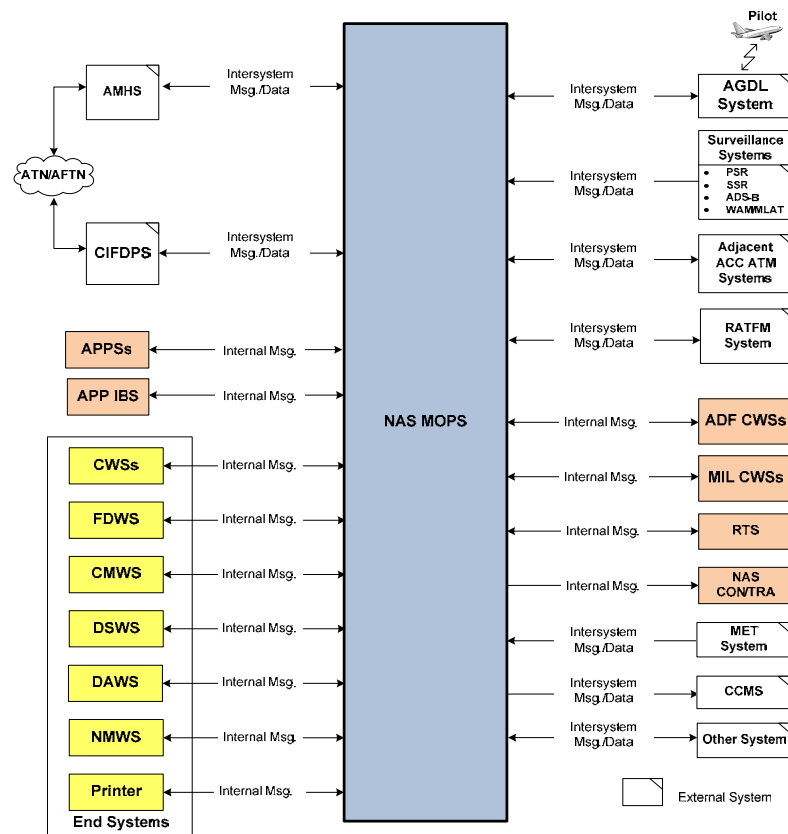
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- Centralized security monitoring that allows specific users to monitor and log system status and security events such as all user access and intrusion.

4.2 The NAS MOPS

Figure 6 summarizes the context where the NAS MOPS operates, exchanging data with the External Systems and the pertinent Internal Systems.



ACC : Area Control Centre
ADF : Air Defense
ADS-B : Automatic Dependent Surveillance – Broadcast
AFTN : Aeronautical Fixed Telecommunication Network
AGDL : Air-Ground Data Link
AIS : Aeronautical Information Service
AMHS : Aeronautical Message Handling System
APP : Approach Control
APPS: Approach Control Systems (BAPP, CMA APP, HTY APP, PUT APP, PSL APP, HHN APP)
ATM : Air Traffic Management
ATN : Aeronautical Telecommunication Network
CCMS : Central CNS/ATM Monitoring System
CIFDPS : Central Initial Flight Data Processing System
CMWS : Control and Monitoring Workstation
CONTRA : Contingency and Training System
CWSs : Controller Workstation
DAWS : Data Analysis Workstation
DSWS : Data Set Workstation
FDWS : Flight Data Workstation
IBS : Independent Backup System
MET : Meteorological
MIL : Military Tower Operator
MLAT : Multi Lateration Surveillance System
MOPS : Main Operation System
Msg: Messages
NAS : Nationwide Air Traffic Management System
NMWS : Network Management Workstation
PSR : Primary Surveillance Radar
RTS : Remote Tower System
RATFM : Regional Air Traffic Flow Management
SSR : Secondary Surveillance Radar
WAM : Wide Area MLAT

Figure 6 Intersystem Connections of the NAS MOPS

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The NAS MOPS provides the following external interfaces to each of the external systems identified as listed in table below.

External System	Comm. Protocol	System Dimension	I/P Ch. (Ch.A +Ch.B)
AMHS	TCP/IP	1	1+1
CIFDPS	TCP/IP	1	1+1
AGDL System	TCP/IP	2	2+2
Surveillance Systems			
1. SSR/PSR	TCP/IP	32	32+32
2. SSR/PSR	Synchronous	4	4+4
3. ADS-B	TCP/IP	12	12+12
4. WAM	TCP/IP	16	16+16
5. MLAT	TCP/IP	16	16+16
Adjacent ACC ATM Systems	TCP/IP	6	6+6
RATFM	TCP/IP	1	1+1
MET System	TCP/IP	1	1+1
CCMS	TCP/IP	1	1+1
Other Systems	TCP/IP	1	1

Table 1 NAS MOPS Intersystem Interface Description

4.2.1 NAS MOPS – AMHS

NAS MOPS is capable of connecting with AMHS to exchange, at minimum, the following information:

Message/Data	Data Format	Input / Output	Reference ICD
FPL message	ICAO standard format – Doc 4444 with Edition 15 Amendment 2 (NEW FPL Format 2012)	Input	ICAO Standard
MET message	ICAO standard format	Input	ICAO Standard
DEP message	ICAO standard format – Doc 4444 with Edition 15 Amendment 2 (NEW FPL Format 2012)	Output	ICAO Standard
ARR message	ICAO standard format – Doc 4444 with Edition 15 Amendment 2 (NEW FPL Format 2012)	Output	ICAO Standard

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Message/Data	Data Format	Input / Output	Reference ICD
Other ATS messages	ICAO standard format – Doc 4444 with Edition 15 Amendment 2 (NEW FPL Format 2012)	Input/Output	ICAO Standard

Table 2 NAS MOPS – AMHS Information Exchange Description

NAS MOPS is capable of using both AFTN and AMHS for this AMHS connection.

4.2.2**NAS MOPS – CIFDPS**

NAS MOPS connects with CIFDPS, which supports FDMC operation, to exchange, at minimum, the following information:

Message/Data	Data Format	Input / Output	Reference ICD
Pre-processed FPL message	ICAO standard format – Doc 4444 with Edition 15 Amendment 2 (NEW FPL Format 2012)	Input	ICAO Standard
AIS message	ICAO standard format	Input	ICAO Standard
MET message	ICAO standard format	Input	ICAO Standard
DEP message	ICAO standard format – Doc 4444 with Edition 15 Amendment 2 (NEW FPL Format 2012)	Output	ICAO Standard
ARR message	ICAO standard format – Doc 4444 with Edition 15 Amendment 2 (NEW FPL Format 2012)	Output	ICAO Standard
Other ATS messages	ICAO standard format – Doc 4444 with Edition 15 Amendment 2 (NEW FPL Format 2012)	Input/Output	ICAO Standard
Terminated FPL data	Legacy Format	Output	Tenderer-provided ICD
System FPL data	Legacy Format	Output	Tenderer-provided ICD
System Track data	ASTERIX Cat. 062, 063, 065	Output	Tenderer-provided ICD
Other relevant AFTN/AMHS messages	ICAO standard format	Input/Output	ICAO Standard

Table 3 NAS MOPS – CIFDPS Information Exchange Description

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NAS MOPS is capable of using both AFTN and AMHS for this CIFDPS connection. Also NAS MOPS will use TCP/IP as connection protocol.

4.2.3 NAS MOPS –APPSs (BAPP, CMA APP, HTY APP, PUT APP, PSL APP, HHN APP)

NAS MOPS connects with APPSs to coordinate in order to support BACC/BAPC operation. The connection may use internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

4.2.4 NAS MOPS – APP IBS

NAS MOPS connects with APP IBS to coordinate in order to support BACC/BAPC operation. This connection will be utilized in case of contingency situation when the APP IBS is configured to operate in place of an affected APPS. The connection may use internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

4.2.5 NAS MOPS – End Systems

End Systems consist of at least CWSs, FDWS, CMWS, DSWs, DAWs, NMWS, and printers. NAS MOPS connects with End Systems using internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

4.2.6 NAS MOPS – AGDL System

NAS MOPS connects with AGDL System to exchange all air-ground data communications to pilot using the following format:

Message/Data	Data Format	Input / Output	Reference ICD
CPDLC message	ACARS , FANS 1/A, ATN	Input/Output	Tenderer-provided ICD
DCL message	ACARS , FANS 1/A, ATN	Input/Output	Tenderer-provided ICD
ADS-C message	ACARS , FANS 1/A, ATN	Input/Output	Tenderer-provided ICD

Table 4 NAS MOPS – AGDL Systems Information Exchange Description

At the present, the major air-ground data link service providers in the world are ARINC and SITA. Therefore NAS MOPS will need to provide connections to both ARINC and SITA.

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4.2.7 NAS MOPS – Surveillance Systems

NAS MOPS connects with Surveillance Systems to receive, at minimum, the following information:

Message/Data	Data Format	Input / Output	Reference ICD
SSR data	ASTERIX Cat.001, 002	Input	Tenderer-provided ICD
SSR Mode-S data	ASTERIX Cat.034, 048	Input	Tenderer-provided ICD
PSR data	ASTERIX Cat.001, 002	Input	Tenderer-provided ICD
Weather data (from PSR)	ASTERIX Cat.008	Input	Tenderer-provided ICD
MLAT/WAM data	ASTERIX Cat.019,020	Input	Tenderer-provided ICD
ADS-B data	ASTERIX Cat.021	Input	Tenderer-provided ICD

Table 5 NAS MOPS – Surveillance Systems Information Exchange Description

4.2.8 NAS MOPS – Adjacent ACC ATM Systems

NAS MOPS connects with Adjacent ACC ATM System to exchange, at minimum, the following information:

Message/Data	Data Format	Input / Output	Reference ICD
Coordination messages	ICAO AFTN AIDC	Input/output	Tenderer-provided ICD
System Track data	ASTERIX Cat.062, 063, 065	Input/output	Tenderer-provided ICD

Table 6 NAS MOPS – Adjacent ACC ATM System Information Exchange Description

4.2.9 NAS MOPS – Regional Air Traffic Flow Management (RATFM)

NAS MOPS connects with RATFM to exchange, at minimum, the following information:

Message/Data	Data Format	Input / Output	Reference ICD
Slot messages	TBD*	Input	Tenderer-provided ICD
Flight plan data	TBD*	Output	Tenderer-provided ICD
Surveillance enhanced trajectories	TBD*	Output	Tenderer-provided ICD
Airspace structure	TBD*	Output	Tenderer-provided ICD
Sectorisation	TBD*	Output	Tenderer-provided ICD

TBD* : To be discussed later

Table 7 NAS MOPS – RATFM Information Exchange Description

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4.2.10**NAS MOPS – Air Defence Workstations**

The scope of TMCS includes Air Defence Workstations provided for appropriate Air defence units. NAS MOPS connects to those Air Defence Workstations to coordinate information in order to support BACC/BAPC operation. The NAS MOPS-Air Defence Workstation connection may use internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

4.2.11**NAS MOPS – Military Tower Workstations**

The scope of TMCS also includes Military Tower Workstations provided for associated military airports. NAS MOPS connects to those Military Tower Workstations to coordinate information in order to support BACC/BAPC operation. The NAS MOPS - Military Tower Workstations connection may use internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

4.2.12**NAS MOPS – Remote Tower System (RTS)**

NAS MOPS connects with associated Remote Tower System to coordinate in order to support BAPC operation. The connection may use internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

4.2.13**NAS MOPS – NAS CON/TRA**

NAS MOPS connects with NAS CON/TRA to synchronize their databases. For essential data, the update should be instantaneous in order to provide the complete operable system in case of contingency situation. For synchronization of the whole database, the update procedure should include specific time interval configuration. Consequently, the connection between NAS MOPS and NAS CON/TRA will need to be robust and has enough bandwidth for the synchronization purpose. AEROTHAI will provide fibre optics link connection between buildings. However, within corresponding building, the vendor will provide cabling and configure network connection for both NAS MOPS and NAS CON/TRA to connect to the available fibre optic connection nodes.

4.2.14**NAS MOPS – MET System**

NAS MOPS connects with MET System to receive, at minimum, the following information:

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Message/Data	Data Format	Input / Output	Reference ICD
GRIB messages	GRIB	Input	Tenderer-provided ICD
Weather Radar data	TBD*	Input	Tenderer-provided ICD

TBD* : To be discussed later

Table 8 NAS MOPS – MET System Information Exchange Description

4.2.15 NAS MOPS – CCMS

NAS MOPS connects with CCMS to send update information of system status warning and alarm messages using the following format:

Message/Data	Data Format	Input / Output	Reference ICD
System Status data	TBD*	Output	Tenderer-provided ICD

TBD*: To be discussed later based on Simple Network Management Protocol (SNMP)

Table 9 NAS MOPS – CCMS Information Exchange Description

4.2.16 NAS MOPS – Other Systems

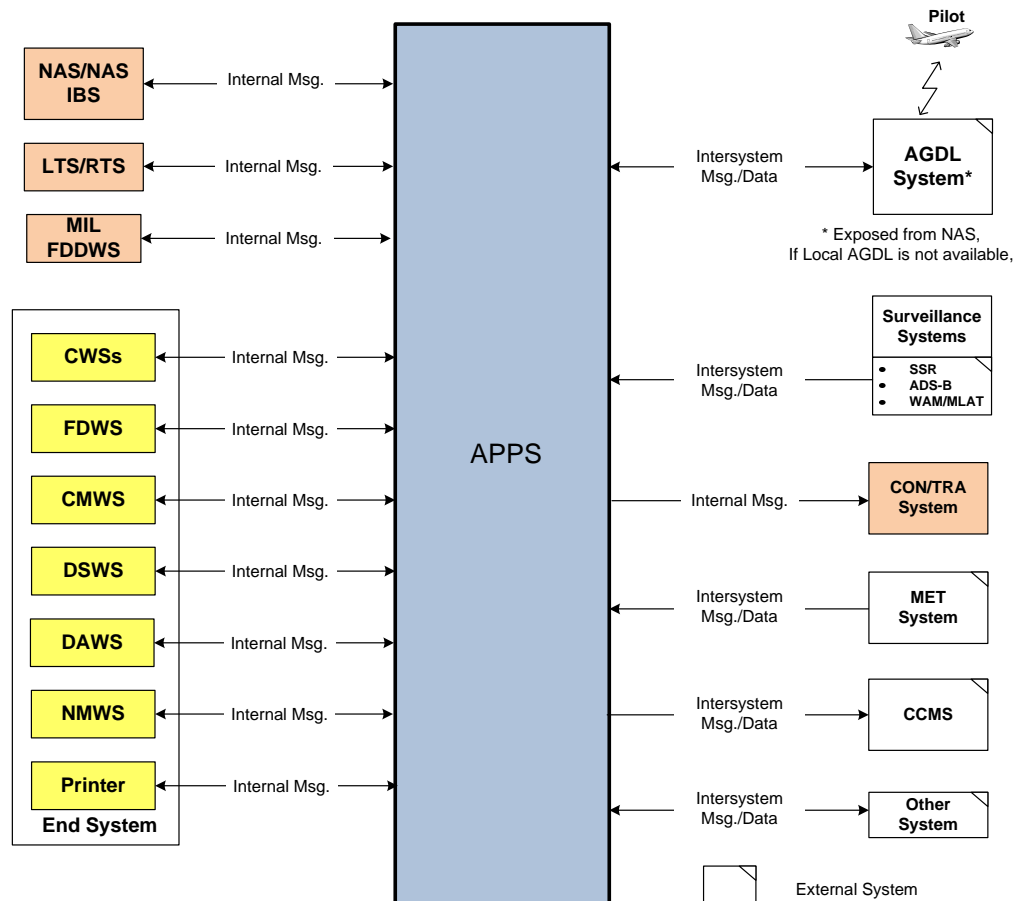
NAS MOPS connects with other systems to exchange AIM-related information using, at minimum, the following format:

Message/Data	Data Format	Input / Output	Reference ICD
AIM/AIXM messages	AIXM Version 4.5 or better	Input/Output	Tenderer-provided ICD

Table 10 NAS MOPS – Other Systems Information Exchange Description

4.3 APPS

Figure 7 summarizes the context where the APPS operates, exchanging data with the External Systems and the pertinent Internal Systems.



ADS-B : Automatic Dependent Surveillance - Broadcast
AGDL : Air-Ground Data Link
APP : Approach Control
APPS : Approach Control Systems (BAPP, CMA APP, HTY APP, PUT APP, PSL APP, HHN APP)
CCMS : Central CNS/ATM Monitoring System
CMWS : Control and Monitoring Workstation
CWSs : Controller Workstation
DAWS : Data Analysis Workstation
DSWS : Data Set Workstation
FDDWS : Flight Data Display Workstation
FDWS : Flight Data Workstation

IBS : Independent Backup System
MET : Meteorological
MIL : Military Tower Operator
MLAT : Multi Lateration Surveillance System
Msg. : Messages
NAS : Nationwide Air Traffic Management System
NMWS : Network Management Workstation
PSR : Primary Surveillance Radar
RTS : Remote Tower System
SSR : Secondary Surveillance Radar
WAM : Wide Area MLAT

Figure 7 Intersystem Connection Context Diagram for the APPS MOPS

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In order to support the operation of BAPP, CMA APC, HTY APC, PUT APC, PSL APC, and HHN APC, each unit will have its own APPS. The APPS provides the following external interfaces to each of the external systems identified.

External System	Comm. Protocol	System Dimension	I/P Ch. (Ch.A +Ch.B)
AGDL System	TCP/IP	2	2+2
Surveillance Systems			
1. SSR	TCP/IP	8	8+8
2. SSR	Synchronous**	2	2+2
3. PSR	TCP/IP	1	1+1
4. PSR	Synchronous**	1	1+1
5. ADS-B	TCP/IP	4	4+4
6. WAM	TCP/IP	3	3+3
7. MLAT	TCP/IP	4	4+4
MET System	TCP/IP	1	1+1
CCMS	TCP/IP	1	1+1

** BAPP System only

Table 11 APPS Intersystem Interface Description

4.3.1 APPS – NAS MOPS / NAS IBS

The APPS connects with NAS MOPS / NAS IBS using internal messages.

4.3.2 APPS – LTS/RTS

APPS connects with associated Remote Tower System to coordinate in order to support corresponding APP System operation. The connection may use internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

4.3.3 APPS – End Systems

End Systems consist of at least CWSs, FDWS, CMWS, DSWS, DAWS, NMWS, and printers. APPS connects with End Systems using internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

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4.3.4 APPS – AGDL System

Depending on availability, APPS connects with AGDL System to exchange all air-ground data communications to pilot using the data format as previously described (NAS MOPS – AGDL System).

If APPS connects to AGDL System, then the APPS will need to provide connections to both ARINC and SITA.

4.3.5 APPS – Surveillance Systems

APPS connects with Surveillance Systems to receive, at minimum, the information as described previously (NAS MOPS – Surveillance Systems).

4.3.6 APPS –CON/TRA

APPS connects with corresponding CON/TRA to synchronize their databases. For essential data, the update should be instantaneous in order to provide the complete operable system in case of contingency situation. For synchronization of the whole database, the update procedure should include specific time interval configuration. Consequently, the connection between APPS and CON/TRA will need to be robust and has enough bandwidth for the synchronization purpose. AEROTHAI will provide communication link between Buildings. Therefore, the Tenderer will provide cabling and configure network connection with enough performance to satisfy APPS to APP CON/TRA synchronization.

4.3.7 APPS – MET System

APPS connects with MET System to receive, at minimum, the information as described previously (NAS MOPS – MET System).

4.3.8 APPS – CCMS

APPS connects with CCMS to send update information of system status warning and alarm messages using the format as described previously (NAS MOPS – CCMS).

4.3.9 APPS – Other Systems

NAS MOPS connects with other systems to exchange AIM-related information using the format as described previously (NAS MOPS – Other Systems).

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4.4 Local Tower System (LTS) / Remote Tower System (RTS)

LTS and RTS under the scope of TMCS are categorized into 4 levels by their respective system capabilities. The details are as follow:

Level – I: There are four (4) tower systems within this level:

- Korat Tower system,
- Takhli Tower system,
- U-tapao Tower system, and
- Kampangsan Tower system.

Level – II: There are twenty eight (28) tower systems within this level:

- Phitsanulok Tower system,
- Hua Hin Tower system,
- Khon Kaen Tower system,
- Chiang Rai Tower system,
- Ubon Ratchathani Tower system,
- Krabi Tower system,
- Surat Thani Tower system,
- Sakon Nakhon Tower system,
- Nakhon Phanom Tower system,
- Nakhon Ratchasima Tower system,
- Petchaboon Tower system,
- Nan Tower system,
- Phare Tower system,
- Loei Tower system,

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- Buriram Tower system,
- Roi Et Tower system,
- Surin Tower system,
- Chumporn Tower system,
- Trat Tower system,
- Mae Hong Son Tower system,
- Lampang Tower system,
- Sukhothai Tower system,
- Tak Tower system,
- Mae Sod Tower system,
- Ranong Tower system,
- Trang Tower system,
- Pattani Tower system, and
- Narathiwat Tower system.

Level – III: There are six (6) tower systems within this level:

- Chiang Mai Tower system,
- Hat Yai Tower system,
- Phuket Tower system,
- Udon Thani Tower system,
- Samui Tower system, and
- Nakhon Si Thammarat Tower system.

Level – IV: There are two (2) tower systems within this level:

- Suvarnabhumi Tower system, and
- Don Muang Tower system.

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Figure 8 depicts the diagram of tower system context with system capabilities level III and IV. Figure 9 depicts the diagram of tower system context with system capabilities level I and II.

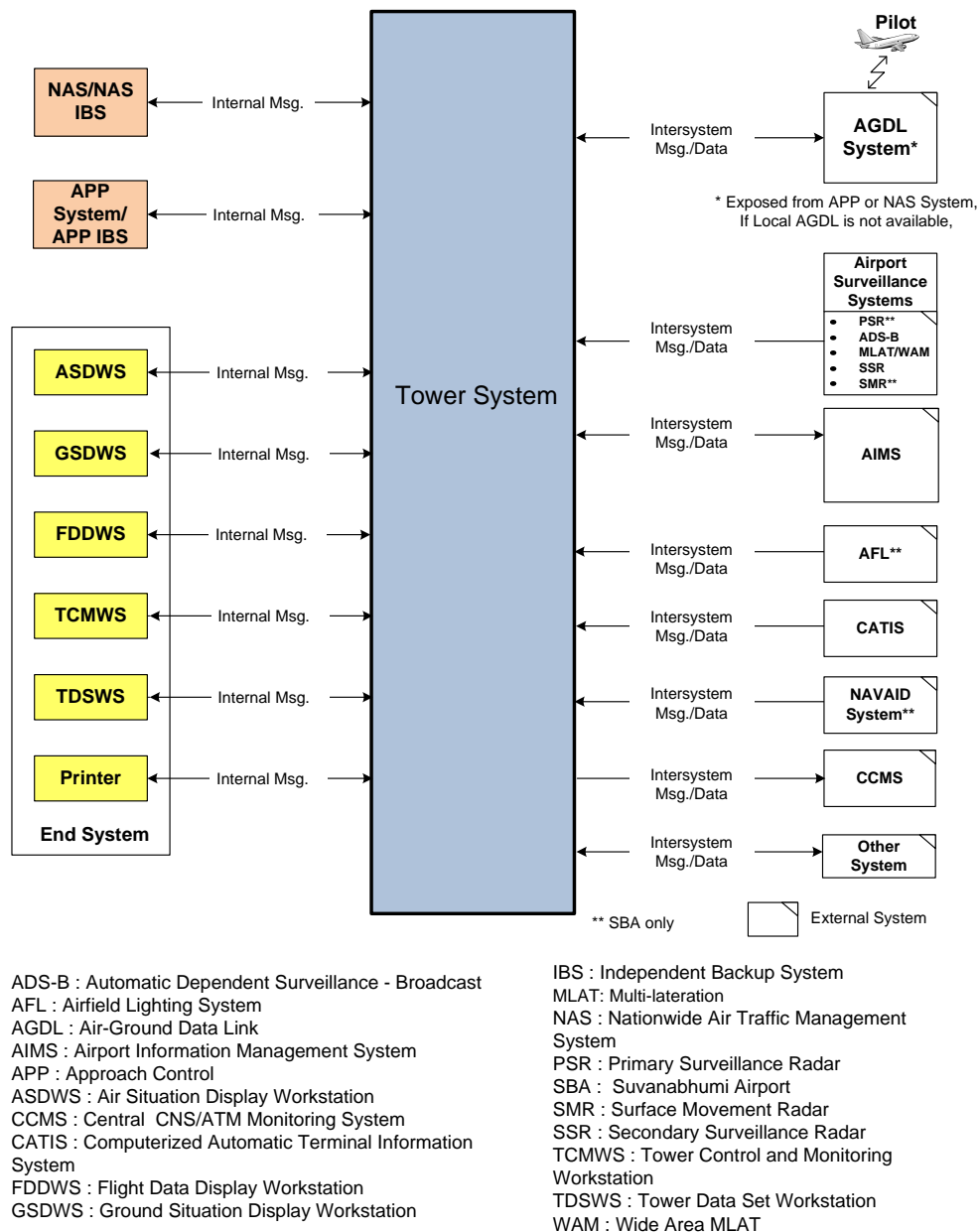


Figure 8 Tower System Context Diagram (System Capabilities Level III and IV)

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4.4.1 Tower System Level III and IV

The tower system provides the following external interfaces to each of the external systems as follow:

External System	Comm. Protocol	System Dimension	I/P Ch. (Ch.A +Ch.B)
AGDL System	TCP/IP	1	1+1
Surveillance Systems			
1. SMR*	TCP/IP	2	2+2
2. PSR*	TCP/IP	1	1+1
3. SSR	TCP/IP	2	2+2
4. ADS-B	TCP/IP	3	3+3
5. MLAT/WAM	TCP/IP	4	4+4
AIMS	TCP/IP	1	1+1
AFL*	TCP/IP	1	1+1
CATIS	TCP/IP	1	1+1
NAVAID System*	TCP/IP	1	1+1
CCMS	TCP/IP	1	1+1

* Only for SBA

Table 12 Tower System Intersystem Interface Description

a) Tower System – NAS MOPS / NAS IBS

Tower System connects with NAS MOPS / NAS IBS using internal messages.

b) Tower System – APPS / APPS IBS

Tower System connects with APPS / APPS IBS using internal messages.

c) Tower System – End Systems

End Systems consist of at least ASDWS, GSDWS, FDDWS, TCMWS, TDSWS, and printers. Tower system connects with End Systems using internal messages. However, where applicable, the Tenderer will provide ICD for this connection.

d) Tower System – AGDL System

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Depending on availability, tower system connects with AGDL System to exchange all air-ground data communications to pilot using the data format as previously described (NAS MOPS – AGDL System).

If tower system connects to AGDL System, then the tower system will need to provide connections to both ARINC and SITA.

e) Tower System – Airport Surveillance Systems

Tower system connects with Surveillance Systems to receive, at minimum, the following information:

Message/Data	Data Format	Input / Output	Reference ICD
SSR data	ASTERIX Cat.001, 002	Input	Tenderer-provided ICD
SSR Mode-S data	ASTERIX Cat.034, 048	Input	Tenderer-provided ICD
PSR data	ASTERIX Cat.001, 002	Input	Tenderer-provided ICD
MLAT/WAM data	ASTERIX Cat.019, 020	Input	Tenderer-provided ICD
ADS-B data	ASTERIX Cat.021	Input	Tenderer-provided ICD
SMR data	ASTERIX Cat.010	Input	Tenderer-provided ICD
System Track data	ASTERIX Cat.062, 063, 065	Input	Tenderer-provided ICD

Table 13 Tower System – Surveillance Systems Information Exchange Description

f) Tower System – AIMS

Tower system connects with AIMS (Airport Information Management System) to coordinate information in order to support its operation using, at minimum, the following information:

Message/Data	Data Format	Input / Output	Reference ICD
Estimated Time of Arrival (ETA), Actual Time of Arrival (ATA), Actual Time of Departure (ATD)	ICAO Standard	Output	Tenderer-provided ICD
Parking Stand Number (PSN), On Block (ONBL), Off Block (OFBL)	ICAO Standard	Input	Tenderer-provided ICD

Table 14 Tower System – AIMS Information Exchange Description

Messages exchanged between them should be transferred via the Firewall/Gateway.

g) Tower System – AFL System

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Tower system connects with AFL System to coordination. Tower system should be able to control the air field lighting via AFL System and receive lighting status such as taxiway centreline lights, stopbars, etc.

Message/Data	Data Format	Input / Output	Reference ICD
AFL System Data	TBD*	Output	Tenderer-provided ICD

TBD*: To be discussed later

Table 15 Tower System – AFL System Information Exchange Description

h) Tower System – CATIS System

Tower system is capable of interfacing with the Computerized Automatic Terminal Information System (CATIS) manufactured by AEROTHAI. Messages transferred between them include, at minimum, CATIS messages based on ICAO standards.

The actual CATIS text information will be displayed as part of the weather display in order to allow the operator to compare the broadcast message with the displayed weather data. As soon as the text changes, all operators should be notified a message and the aural signal and the changes should be highlighted on the display. The highlighting should be cleared when the operator accepts the notification. All client positions should be notified with system control messages about the state of connection to CATIS.

Message/Data	Data Format	Input / Output	Reference ICD
CATIS Data	TBD*	Output	Tenderer-provided ICD

TBD*: To be discussed later

Table 16 Tower System – CATIS System Information Exchange Description

i) Tower System – NAVAID System

Tower system connects with NAVAID to acquire the NAVAID systems status. Tower system receives the status of navigation aids in order to present to controllers.

Message/Data	Data Format	Input / Output	Reference ICD
NAVAID System Status Data	TBD*	Output	Tenderer-provided ICD

TBD*: To be discussed later

Table 17 Tower System – NAVAID System Information Exchange Description

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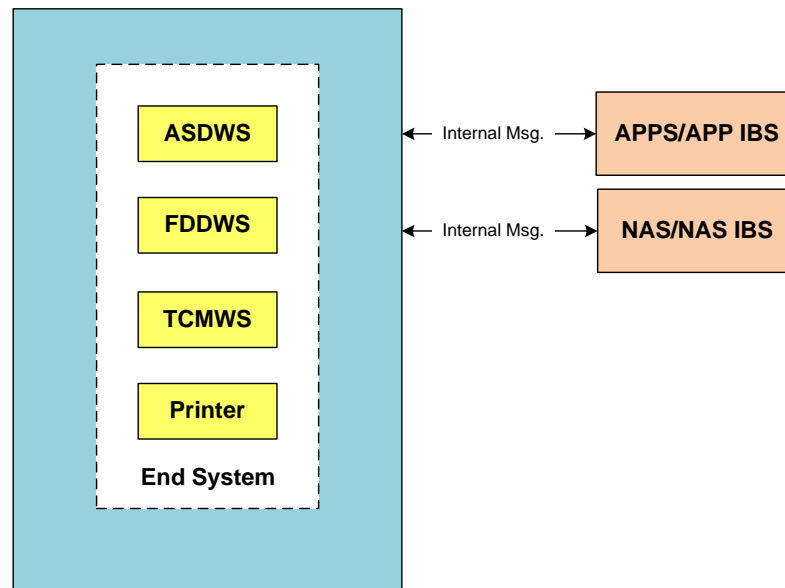
j) Tower System – CCMS

Tower system connects with CCMS to send update information of system status warning and alarm messages using the format as described previously (NAS MOPS – CCMS).

k) Tower System – Other Systems

Tower system connects with other systems to exchange AIM-related information using the format as described previously (NAS MOPS – Other Systems).

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APP : Approach Control
APPS : Approach Control Systems (BAPP, CMA
APP, HTY APP, PUT APP, PSL APP, HHN APP)
ASDWS : Air Situation Display Workstation
FDDWS : Flight Data Display Workstation
IBS : Independent Backup System

NAS : Nationwide Air Traffic Management
System
TCMWS : Tower Control and Monitoring
Workstation

Figure 9 Tower System Context Diagram (System Capabilities Level I and II)

4.4.2 Tower System Level I and II

The Tower System for system capabilities level I and II provides the following interfaces to pertinent internal systems as follow:

a) Tower System – NAS MOPS / NAS IBS

Tower System connects with NAS / NAS IBS using internal messages.

b) Tower System– APPS / APPS IBS

Tower System connects with APPS / APPS IBS using internal messages.

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5 Operator Roles and Workstations

5.1 BACC/BAPC, BAPP, APPs, CON/TRA

5.1.1 Operator Roles

Operator roles for BACC/BAPC, BAPP, APPS, and CON/TRA consist of

- Executive Controller (EC),
- Planner Controller (PC),
- Arrival Manager (AMAN),
- Tactical Supervisor (TACTSUP),
- Civil Military Airspace Coordinator (CMAC),
- Operational Supervisor (OPSUP),
- Flight Information Specialist (FISL),
- Technical Supervisor (TECHSUP),
- Evaluation Operator (EO),
- Airspace Manager (ASM),
- Bangkok Air Traffic Flow Management Unit Manager (FMM),
- Bangkok Air Traffic Flow Management Unit Planner / Coordinator (FMC),
- Flight Data Operator (FDO),
- Data Set Operator (DSO),
- Air Defense Operator (ADF),
- Maintenance Engineer (MTN),
- Trainee (TRN),
- Pseudo Pilot (PSP), and
- Training Mission Control (TMC).

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5.1.2 Support Facility

Support facility for operator roles for BACC/BAPC, BAPP, APPS, and CON/TRA consists of both hardware and software. The characteristic of each category are described as follow:

a) Hardware Characteristic:

Hardware characteristic for operator roles consists of Touch Entry Device (TED) panel and workstation type. There are three (3) types of workstation as follow:

- Type A consists of one workstation-grade computer, one 2K x 2K LCD monitor, and one 24" LCD monitor.
- Type B consists of one workstation-grade computer and one 24" LCD monitor.
- Type C consists of one workstation-grade computer and one 30" LCD monitor.

b) Software Characteristic:

Software characteristic for operator roles are as follow:

- Controller Workstation (CWS) Human Machine Interface (HMI) Function,
- Control and Monitoring System (CMS) Function,
- Network Management System (NMS) Function,
- Flight Data Operator (FDO) Function,
- Data Set Management (DSM) Function,
- Data Analysis (DAA) Function,
- Pilot Function, and
- Training Mission Control (TMC) Function.

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5.1.3 Mapping between Workstations and Software Characteristics to support Operator Role

In order to support the work of any operator role, a set of hardware will be equipped and/or configured with appropriate software. The mapping table gives examples of mapping between hardware and software for all operator roles. The Tenderers are encouraged to use this mapping example as an initial guideline and modify the content accordingly.

The operator role layouts are presented in attachments.

	Role	Facility				
		HW Characteristic			SW Characteristic	Workstation Name
		Workstation (set)	TED panel	Printer		
1	EC	One (1) Type A	1	0	CWS HMI Function	CWS
2	PC	One (1) Type A	1	0	CWS HMI Function	CWS
3	AMAN	One (1) Type A	1	0	CWS HMI Function	CWS
4	TACTSUP	One (1) Type A	1	0	CWS HMI Function	CWS
5	CMAC	One (1) Type A	1	0	CWS HMI Function	CWS
6	OPSUP	One (1) Type A	1	1	CWS HMI Function	CWS
7	FISL	One (1) Type A	1	0	CWS HMI Function	CWS
8	TECHSUP	One (1) Type A	1	0	CWS HMI Function	CWS
		One (1) Type B			CMS Function	CMWS
9	EO	Two (2) Type A	2		CWS HMI Function	CWS
		One (1) Type B		1	DA Function	DAWS
10	ASM	One (1) Type A	1	0	CWS HMI Function	CWS
11	MTN	Two (2) Type A	2	0	CWS HMI Function	CWS
		One (1) Type B			CMS Function	CMWS
		One (1) Type B			NMS Function	NMWS
12	TRN	One (1) Type A	1	0	CWS HMI Function	CWS
13	FMM	One (1) Type C	1	1	CWS HMI Function	CWS
14	FMC	One (1) Type C	1	0	CWS HMI Function	CWS
15	ADF	One (1) Type C	0	0	CWS HMI Function	CWS
16	FDO	One (1) Type B	0	0	FDO Function	FDWS
17	DSO	One (1) Type B	0	1	DSM Function	DSWS
18	PSP	One (1) Type B	1	0	Pilot Function	PSPWS
19	TMC	One (1) Type B	0	0	TMC Function	TMCWS

Table 18 Mapping Table to support Operator Role of BACC/BAPC, BAPP, APPs, CON/TRA

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CWS : Controller Workstation

CMWS : Control and Monitoring Workstation

NMWS : Network Management Workstation

FDWS : Flight Data Workstation

DSWS : Data Set Workstation

DAWS : Data Analysis Workstation

PSPWS : Pseudo Pilot Workstation

TMCWS : Training Mission Control Workstation

- Operator Role Description

- a) Executive Controller

The Executive Controller (EC) has executive authority, and responsibility, for the Air Traffic Management within the airspace/sector delegated. EC is responsible for fulfilling the following specific tasks:

- Monitor airspace/sector frequency(s), and performing all R/T communication;
- Identify aircraft which are not identified when entering the airspace/sector;
- Identify and accept of aircraft being transferred from adjacent airspace/sector;
- Provide clearance of aircraft within the airspace/sector in accordance with the overall plan, and the co-ordination agreements, established by the Planning Controller (PC);
- Monitor aircraft within the airspace/sector to ensure no deviation from the clearances;
- Provide radar separation between all IFR flights within the airspace/sector;

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- Coordinate, when required, with other controllers authorized to perform air traffic control within the same airspace/sector;
- Initiate transfer of aircraft leaving the airspace/sector for the next adjacent airspace/sector;
- Maintain an awareness of pertinent weather information which might influence the conduct of flights within the airspace/sector;
- Ensure that the display set-up provides adequate coverage of the airspace/sector, and that the selected display complies with a 'Minimum Required Data' defined to support the duties of an EC;
- Maintain an awareness of significant system downgrades which affect the actual radar range, operational coverage and system behavior;
- Check routinely of the accuracy of the displayed label information on all own flights under control, particularly when establishing initial contact;
- Ensure that all radar tracks, in respect of known traffic, within the airspace/sector, are correctly correlated;
- Keep the Operational Supervisor informed of any irregularities, e.g. air-miss, loss of separation, breach of regulations, etc., and where appropriate, submits a report; and
- Delegate tasks, when appropriate, to the PC to ensure an even distribution of workload within the airspace/sector.

b) Planning Controller

The Planning Controller (PC) is responsible for fulfilling the following specific tasks:

- Initiate prediction of potential traffic conflicts within the airspace/sector;
- Assess potential conflicts before the traffic enters the airspace/sector, and the appropriate acceptance, or amendment of the traffic's entry configuration;

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- Modify established planning clearances and/or co-ordination exceptionally, and when circumstances require immediate action;
- Plan conflict-free flight paths through the area of responsibility;
- Effect radar co-ordination according to laid-down (local) criteria, with adjacent/subjacent airspace/sectors or units;
- Apply manual correlation to an identified flight and its system flight plan when necessary due to loss of correlation or failure of automatic correlation;
- Ensure that the appropriate ATM system is kept updated with regard to control instructions within the airspace/sector;
- Give assistance to the EC as required;
- Keep the Operational Supervisor informed of any
 - malfunctions of equipment or facilities;
 - potential traffic overloads of the airspace/sector; and circumstances occurring in which any aircraft might be endangered, e.g. emergency, hi-jack, etc.

Note: PC should be able to perform as Multi sector Planner Controller (MSP). MSP responsibilities are the same as for the PC; but the MSP has responsibilities in more than one sector and serves multiple EC role positions. The MSP makes assessments of potential conflicts before the traffic enters own sector(s).

c) Arrival Manager

The Arrival Manager (AMAN) will be able to allocate arrival routes and set constraints such as Time Based Spacing (TBS) or Miles-In-Trail (MIT) on merging points with the objective of building an optimum sequence. There should be several techniques available, for example, Control Time of Arrival (CTA), speed control, radar vectoring, etc. Note that, when appropriate, the AMAN's functions may be consolidated with other operator roles' functions such as ATFM or PC.

The minimum tasks of arrival manager include:

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- Consider the Reference Business Trajectory (RBT); (The preparation of the arriving traffic sequence is expected to be completed by around 20 mins prior to touchdown, and should start only as early as necessary to achieve the stated objectives. It is thought that at least 1 hour will be needed to smooth out ripples in the traffic delivery, which will be the result of RBT, which is expected to be +/- 2 or 3 minutes.)
- Monitor the progress of flight;
- Give recommendation to EC/PC using techniques to satisfy multiple constraints.
- Coordinate among arrival managers (AMAN ACC, AMAN APP) departure managers (DMAN), ATFM, FM, Airport Operator, other relevant stake holders.

d) Tactical Supervisor

Tactical Supervisor (TACTSUP) is responsible for fulfilling the following specific tasks:

- Assess quality the operation within TACTSUP's operational team,
- Examine the operation within TACTSUP's operational team,
- Provide, when necessary, the appropriate restrictions for air traffic operations due to equipment failures or staff shortages within the area of responsibility,
- Lead, together with the Operation Supervisor (OPSUP), for daily operational activities, and
- Participate in management and development of operational activities, as well as staffing and manning of sectors and positions.

e) Civil Military Airspace Coordinator

The Civil Military Airspace Coordinator (CMAC) is a centralized role within airspace management units for joint civil-military activities. The CMAC's primary objective is to maximize the utilization of available airspace by

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dynamic time-sharing and, at times, by segregating airspace among various categories of users based on short-term needs. They collaborate in the planning of airspace usage in a way that balances the impact on civil air traffic flow and capacity management with military needs. The CMAC's responsibilities are, but not limited to:

- Coordinate well in advance of major airspace events, such as large scale military exercises or air shows, which require additional segregated airspace;
- Coordinate with Air Space Manager (ASM) and Bangkok Air Traffic Flow Management Unit Manager (FMM) to consider the expected capacity shortfalls between traffic demand and airspace capacity;
- Develop and distribute of Airspace Use Plans (AUP) to accommodate significant short-term realignment of traffic flows to meet extra-ordinary demands imposed by major events;
- Develop and distribute of Updated Airspace Use Plans (UUP) in case of changes or modifications to airspace allocation;
- Develop and distribute of daily Conditional Route Availability Messages (CRAM); and
- Monitor the efficiency of the application of the FUA Concept by use of predetermined FUA indicators.

f) Operational Supervisor

The Operational Supervisor (OPSUP) leads the daily operational activities at the TMCS. OPSUP responsibilities Include:

- Activate and deactivate of Special Procedures within the area of the OPSUP responsibility;
- Provide, when necessary, the appropriate restrictions for air traffic operations due to equipment failures or staff shortages within the area of responsibility;

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- Provide, when necessary, the Bangkok Air Traffic Flow Management Unit Planner / Coordinator (FMC) with requests for Air Traffic Restrictions; and
- Establish the active runway(s)-in-use and informing all concerned via the information system after coordination with Tower and Approach Supervisor.

g) Flight Information Specialist

Within Flight Information Services, the Flight Information Specialist (FISL) has the responsibility of providing a Flight Information Service (FIS), Radar Information Service and Radar Advisory Service to aircraft operating in ICAO Class G airspace within Bangkok Area of Responsibility and to others that have specifically requested such a service. The FISL will be responsible for the following tasks within ICAO Class G airspace:

- Monitor and performing all R/T communication on frequencies allocated to Flight Information Service sectors;
- Provide Flight Information Services to aircraft by providing pilots, on request, with any relevant aeronautical information such as:
 - runways in use and serviceability of landing and navigational aids;
 - weather both actual and forecasts;
 - frequencies to use when contacting relevant ATC agencies;
 - NOTAM information;
 - un-serviceability or unreliability of ground facilities;
 - an aircraft's proximity to airspace which it is not authorized to enter (i.e. controlled airspace, danger areas, restricted areas, prohibited areas, TSA's);
- Receive air-filed flight plans from aircraft requesting any form of ATC service in Bangkok Area of Responsibility, and relaying the FPLs to the Flight Data Operator (FDO) for further promulgation; and

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- Provide information service to participating IFR and VFR aircraft within the area of responsibility.

h) Technical Supervisor

The Technical Supervisor (TECHSUP) is responsible for the following:

- Maintain of the MOPS and CON/TRA and related systems; and
- Receive status information of all system components and depending on the technical situation and determining (in close collaboration with OPSUP) the appropriate system configuration and the various maintenance actions to be undertaken by the technical staff (TECH).

i) Evaluation Operator

The Evaluation Operator (EO) is responsible for, at minimum:

- Prepare evaluations on recorded system data;
- Perform evaluations on recorded system data;
- Replay recorded data for incident analysis and safety assessments as well as for technical analysis and evaluations; and
- Perform operational data analysis.

j) Airspace Manager

The function of Airspace Managers (ASM) is a centralised one within Airspace Management Cells, which are foreseen as a joint civil-military activity. The Airspace Manager's primary objective is to maximise the utilisation of available airspace by dynamic time-sharing and, at times, by segregating airspace among various categories of users based on short-term needs. They collaborate in the planning of airspace usage in a way that balances the impact on civil air traffic flow and capacity management with military needs. The Air Space Manager's responsibilities are, but not limited to:

- Identify expected capacity shortfalls between traffic demand and airspace capacity;

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- Inform all concerned of early access to weekend routes/conditional routes;
- Provide up-to-date information concerning current use of airspace at tactical level; and
- Coordinate with relevant units to accommodate significant short-term realignment of traffic flows to meet extra-ordinary demands imposed by major events.

k) Bangkok Air Traffic Flow Management Unit (ATFMU) Manager

Bangkok ATFMU Manager (FMM) is responsible for fulfilling the following specific tasks:

- Is responsible for the performance and initiation of the full ATFM process in Bangkok FIR and other area of responsibility in all phases of operation (strategic, pre-tactical and tactical).
- Should be responsible to perform and initiate the strategic phase at Bangkok FMC.
- Is responsible for ensuring that the procedures established for ATFM is published in NOTAM, AIP, ATC operational instructions, etc.
- Is responsible to establish good relations between the FMC and Bangkok ACC, Bangkok Approach as well as with other ATC Units and aviation stakeholders in Thailand and other relevant stakeholders.
- Should be consulted in issues that potentially could reduce the capacity to advice on how the capacity could be maintained as high as possible. In this respect the FMC have to be informed of planned airspace or ATC organizational changes.
- Should work pro-actively in suggesting ways for ATC to be able to increase the capacity.
- Should propose capacity modifications to the management of Bangkok ACC if necessary.

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- Is the focal point in regard of ATFM activity for all Thailand and takes the lead in advising, educating and assisting other ATS Units and Aircraft Operators in Thailand.
- Should together with Bangkok ATFMU Planners / Coordinators develop the ATFM work and the tools necessary for the best performance of Bangkok ACC and airports within area of responsibility

1) Bangkok ATFMU Planner / Coordinator

Bangkok ATFMU Planner / Coordinator (FMC) is responsible for fulfilling the following specific tasks:

- Working in close cooperation with the Supervisors of Bangkok ACC as well as the Supervisors of Bangkok Approach and Towers.
- Are responsible for monitoring the balance between traffic demand and agreed capacity and take necessary ATFM measures when demand is expected to exceed the sector capacity in Bangkok ACC.
- Should analyze, collect and distribute all relevant information, such as meteorological conditions, delays, interruption of communications and runway closures, telecommunication failures, deficient operation of computers, and procedural changes affecting air traffic facilities. This may be accomplished through various means available, such as teleconferences, e-mail, internet, etc.
- Should assist any other ATC Unit in Bangkok FIR and other area of responsibility where demand exceed the capacity and coordinate the ATFM measures. Bangkok ATFMU is in charge of both publication and liaison of such ATFM measures.
- A complete description of all ATFM measures (for example, ground delay programs, Miles-In-Trail (MIT)) should be recorded in a designated log, which must include, among other

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data, the time of start and end, the affected facilities/operations and the justification;

- Should take immediate ATFM action and implement contingency plans as required following reports on sudden, unplanned changes of capacity (e.g. due to equipment failure or weather)
- Should create and distribute the action plan based on prior consultation with the designated facilities and stakeholders;
- Should coordinate procedures with the affected parties during the pre-tactical and tactical phases to ensure proposed ATFM measures fit others' operations.
- Should monitor the effect of the taken ATFM measures for the best efficiency of the ATFM measures, make adjustments where necessary and cancel ATFM measures when no longer required.
- Should inform stake holders that do not follow the ATFM measures in order to reach an understanding for the whole ATFM process.
- Should in the event of ATFM measures in adjacent FIR, on request, assist to the best of its ability to the benefit of all stakeholders.
- Should log the taken ATFM measures either by support of a system or manually on a paper form or logbook.

m) Flight Data Operator

The Flight Data Operator (FDO) is responsible for ensuring that flight data, aeronautical data and meteorological data within the ATM system remains current and complete. In particular, this consists of the following tasks:

- Correct corrupted or invalid ATS messages and re-entry into the system as necessary;
- Enter aeronautical or meteorological data into the system if it cannot be automatically processed;

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- Develop and distribute NOTAM's and meteorological messages; and
- Assign of SSR codes to flights when not performed automatically.

n) Data Set Operator

Data Set Operator (DSO) is responsible for fulfilling the following specific tasks, at minimum:

- Produce the complete set of parameters in a dataset that is specific for the current user environment and a specific system software version,
- Evaluate the dataset, when changes occur, in order to ensure the validity of dataset;
- Produce exercises to the simulator used for training and testing; and
- Coordinate with MTN to distribute the validated dataset to the system.

o) Air Defense Operator

Air Defense Operator (ADF) supports military operation stationed at Air Defense Units which are Big Shell, Oscar, and Focal.

ADF is responsible for fulfilling the following specific tasks, at minimum:

- Provide common situational awareness on traffic situation, airspace activation, route activation, etc.; and
- Coordinate with CMAC, EC/PC, and other relevant stakeholders.

p) Maintenance Engineer

Maintenance Engineer (MTN) coordinates with various units to perform tasks such as TECHSUP, OPSUP, etc. Maintenance Engineer performs maintenance operations include, but not limited to:

- Operate and maintain the NAS MOPS;
- Manage NAS MOPS information;

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- Configure NAS MOPS
- Etc.

Maintenance Engineer will operate in day/night shift (24/7).

q) Trainee

The Trainee (TRN) is position of training the role of EC and PC.

r) Pseudo Pilot Position

The Pseudo Pilot Position (PSP) is responsible for fulfilling the following specific tasks, at minimum:

- Control the aircraft involved in the exercise through the execution of a broad range of instructions as received through the PSP interface;
- Coordinate with respective Training Mission Control (TMC) and converting the received control commands into Air Traffic Generator instructions for execution;

s) Training Mission Control

The Training Mission Control (TMC) is responsible for fulfilling the following specific tasks, at minimum:

- Select a Session and the Games involved;
- Configure the CON System including the CWS for Training Controller and PSP by assigning role configuration commands through the TRA interface;
- Control the individual Exercises, start/stop times, pause/resume commands, record and replay commands; and
- Perform retime/modify/insert new/delete SFPs, weather messages, wind & temperature data, QNH, transition level, ATM messages and component failures both timed and random.

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5.2 Towers**5.2.1 Tower Operator Role**

Tower Operator Role consists of

- Ground Controller (GND),
- Local Controller (LCL),
- Coordinator (COR),
- Clearance Delivery (CDC),
- Tower Tactical Supervisor (T-TACTSUP),
- Departure Manager (DMAN),
- Tower Evaluation Officer (T-EO),
- Tower Flight Data Operator (T-FDO),
- Tower Data Set Operator (T-DSO),
- Military Tower Operator (MIL),
- Flight Announcement Operator (FAO),
- Bay Allocation Operator (BAO),
- Aeronautical Reporting Office (ARO), and
- Tower Maintenance Engineer (T-MTN)

5.2.2 Support Facility

Support facility for operator roles for Towers consists of hardware and software characteristic.

a) Hardware Characteristic :

Hardware characteristic for operator roles consists of TED panel and workstation & monitor type. Support facility for operator roles for Towers also use Type B workstation, however, there is one (1) additional type of workstation & monitor as follow:

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- Type D consists of one workstation-grade computer and one 21” touch-screen LCD monitor.

b) Software Characteristic:

Software characteristic for operator roles are as follow: ASD Function, GSD Function, FDD Function, T-CMS and T-DSO.

5.2.3 Mapping between Tower Operator Role and Tower Workstation Types

In order to support the work of any operator role, a set of hardware will be equipped/configured with appropriate software. The mapping table gives examples of mapping between hardware and software for all operator roles. The Tenderers are encouraged to use this mapping example as an initial guideline and modify the content accordingly.

The operator role layouts are presented in attachments.

	Role	Facility				
		HW Characteristic			SW Characteristic	Workstation Name
		Workstation	TED panel	Printer		
1	LCL	One (1) Type B	1	0	ASD Function	ASDWS
		One (1) Type B			GSD Function	GSDWS
		One (1) Type D			FDD Function	FDDWS
2	COR	One (1) Type B	1	0	ASD Function	ASDWS
		One (1) Type B			GSD Function	GSDWS
		One (1) Type D			FDD Function	FDDWS
3	GND	One (1) Type B	1	0	GSD Function	GSDWS
		One (1) Type D			FDD Function	FDDWS
4	CDC	One (1) Type B	1	0	GSD Function	GSDWS
		One (1) Type D			FDD Function	FDDWS
5	T-TACTSUP	One (1) Type B	1		ASD Function	ASDWS
		One (1) Type B			GSD Function	GSDWS
		One (1) Type D		1	FDD Function	FDDWS
6	DMAN	One (1) Type D	1	0	FDD Function	FDDWS
7	T-FDO	One (1) Type D	0	0	FDD Function	FDDWS
8	T-DSO	One (1) Type B	0	1	T-DSO Function	TDSWS
9	T-EO	One (1) Type B	1	0	ASD Function	ASDWS
		One (1) Type B			GSD Function	GSDWS
		One (1) Type D			FDD Function	FDDWS
10	MIL	One (1) Type D	0	0	FDD Function	FDDWS

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	Role	Facility				
		HW Characteristic			SW Characteristic	Workstation Name
		Workstation	TED panel	Printer		
11	FAO	One (1) Type D	0	0	FDD Function	FDDWS
12	BAO	One (1) Type D	0	0	FDD Function	FDDWS
13	ARO	One (1) Type D	0	1	FDD Function	FDDWS
14	T-MTN	One (1) Type B	1	1	ASD Function	ASDWS
		One (1) Type B			GSD Function	GSDWS
		One (1) Type D			FDD Function	FDDWS
		One (1) Type B			T-CMS Function	TCMWS
		One (1) Type B			T-NMS Function	TNMWS

Table 19 Mapping Table to support Operator Role of Towers

5.2.4**Tower Operator Role Description**

a) Local Controller

Local Controller (LCL) is responsible for fulfilling the following specific tasks, at minimum:

- Ensure runway separation exists between aircraft;
- Issue takeoff and landing instructions/clearances;
- Organize the sequence of the departures in coordination with Departure Manager (DMAN) when available ; and
- Authorize aircraft/vehicle movements on or across runways.

b) Ground Controller

Ground Controller (GND) is responsible for fulfilling the following specific tasks, at minimum:

- Manage traffic on the maneuvering area with the exception of runways;
- Issue push-back/taxi clearances in coordination with Departure Manager (DMAN) when available; and
- Monitor and guide all the aircraft/vehicle movements on the airport maneuvering area except for the runway.

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c) Coordinator

Coordinator (COR) is responsible for fulfilling the following specific tasks, at minimum:

- Coordinate with adjacent Approach Control Unit, GND, LCL, Airport Operator, Airline Operator, other relevant stakeholders;
- Alert the rescue and fire fighting services in the event of an emergency; and
- Issue departure time (ATD) and arrival time (ATA).

d) Clearance Delivery

Clearance Delivery (CDC) is responsible for fulfilling the following specific tasks, at minimum:

- Deliver of ATC clearances to departing IFR flights;

Remark: In case of the Aerodrome Control Tower doesn't have Clearance Delivery Position, the IFR flight plan clearances will be issued by Ground Controller.

e) Tower Tactical Supervisor

The Tower Tactical Supervisor (T-TACTSUP) is responsible for fulfilling the following specific tasks, at minimum:

- Decide on staffing and manning of controllers in accordance with expected traffic demand;
- Alert search and rescue organizations in the event of an aircraft accident;
- Collaborate with adjacent Area Control Centre and Approach Control Unit and Maintenance Engineer (MTN) when available; and
- Select the most appropriate runway-in-use.

f) Departure Manager

The Departure Manager (DMAN) is responsible for fulfilling the following specific tasks, at minimum:

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- Manage the target take-off time (TTOT) and target start-up approval time (TSAT) taking multiple constraints and preference into account; and
- Coordinate and negotiate with appropriate units to maintain the optimal use of runway.

g) Tower Flight Data Operator

The Tower Flight Data Operator (T-FDO) is responsible for ensuring that flight data, aeronautical data and meteorological data within the ATM system remains current and complete. In particular, this consists of the following tasks:

- Correct corrupted or invalid ATS messages and re-entry into the system as necessary;
- Enter aeronautical or meteorological data into the system if it cannot be automatically processed;
- Develop and distribute NOTAM's and meteorological messages; and
- Assign of SSR codes to flights when not performed automatically.

h) Tower Data Set Operator

Tower Data Set Operator (T-DSO) is responsible for fulfilling the following specific tasks, at minimum:

- Produce the complete set of parameters in a dataset that is specific for the current user environment and a specific system software version,
- Evaluate the dataset, when changes occur, in order to ensure the validity of dataset;
- Produce exercises to the simulator used for training and testing; and
- Distribute the validated dataset to the system.

i) Tower Evaluation Operator

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The Tower Evaluation Operator (T-EO) is responsible for, at minimum:

- Prepare evaluations on recorded system data;
- Run evaluations on recorded system data;
- Replay recorded data for incident analysis and safety assessments as well as for technical analysis and evaluations; and
- Perform operational data analysis.

j) Military Tower Operator

The Military Tower Operator (MIL) is responsible for, at minimum:

- Deliver of ATC clearances to departing IFR flights; and
- Issue departure time (ATD) and arrival time (ATA).

k) Flight Announcement Operator

The Flight Announcement Operator (FAO) is responsible for, at minimum:

- Issue flight announcement at the airport.

l) Bay Allocation Operator

The Bay Allocation Operator (BAO) is responsible for, at minimum:

- Issue bay allocation for flight.

m) The Aeronautical Reporting Office

The Aeronautical Reporting Office (ARO) is responsible for, at minimum:

- Insert FPL;
- Generate reports for flight plan related information;
- Retrieve and view FPL; and
- Issue DEP and ARR messages for flight.

n) Tower Maintenance Engineer

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Tower Maintenance Engineer (T-MTN) coordinates with various units to perform tasks such as TECHSUP, OPSUP, etc. to perform maintenance operations include, at minimum:

- Operate and maintain the tower system;
- Manage tower system information; and
- Configure tower system.

Maintenance Engineer will operate in day/night shift (24/7).

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6 Site Information and Network Infrastructure

6.1 Site Information

6.1.1 Tung Mahamek Site

The facilities at Tung Mahamek Site related to TMCS consist of two (2) buildings; which are New Operation Building and Existing Operation Building.

Attachment 6.6.1 illustrates the location of New Operation Building and Existing Operation Building at Tung Mahamek Site.

a) New Operation Building

There are six (6) rooms reserved for TMCS in the New Operation Building.

b) Existing Operation Building

There are three (3) rooms reserved for TMCS in the Existing Operation Building.

Each room is planned for specific operation purpose. Please also be advised that, at the present, there are others servers and equipments installed in the some allocated rooms. The site survey and site evaluation are recommended.

The following table describes the TMCS equipments and their planned installed rooms at Tung Mahamek Site.

	System Name	System Description	Building Name	Floor	Room Function	Room Number	Floor Plan
1	NAS MOPS	End System					
		- BACC/BAPC	New Operation Building	8 th Floor	Operation Room	OPS806	Attachment 6.1.1a
		- Pre-tactical	New Operation Building	3 rd Floor	Pre-tactical Operation Room	OPS301	Attachment 6.1.1b
		Equipment					
		- Redundant Data processing	New Operation Building	2 nd Floor	Equipment Room	OPS201	Attachment 6.1.1c
		- VCCS	New Operation Building	2 nd Floor	Equipment Room	OPS201	Attachment 6.1.1c
		- F-VCCS	New Operation Building	8 th Floor	Fallback System Room	OPS802	Attachment 6.1.1a
2	NAS CON/TRA	End System					
		- BACC/BAPC CON/TRA	Existing Operation Building	3 rd Floor	CON/TRA Room	EXO301	Attachment 6.1.1d
		- Pseudo Pilot	Existing Operation Building	3 rd Floor	Pilot Room	EXO302	Attachment 6.1.1d
		Equipment					
		- Data processing	Existing Operation Building	1 st Floor	Equipment Room	EXO104	Attachment 6.1.1e
		- VCCS	Existing Operation Building	1 st Floor	Equipment Room	EXO104	Attachment 6.1.1e
3	NAS IBS & APP IBS	Equipment					
		- Redundant Data processing	New Operation Building	2 nd Floor	Equipment Room	OPS201	Attachment 6.1.1c
4	UPS	UPS for NAS MOPS					
		- UPS #1	New Operation Building	8 th Floor	UPS #1 Room	OPS804	Attachment 6.1.1a
		- UPS #2	New Operation Building	2 nd Floor	UPS #2 Room	OPS202	Attachment 6.1.1c

Table 20 Summary of Tung Mahamek Site Information

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6.1.2**Chiang Mai Site**

The Chiang Mai Approach Control Centre (CMA APC) Building at Chiang Mai Site has allocated five (5) rooms for TMCS. Each room is planned for specific operation purpose.

Please be advised that, at the present, there are other servers and equipments installed in some rooms. The site survey and site evaluation are recommended.

The following table describes the TMCS equipments and their planned installed rooms at Chiang Mai Site.

	System Name	System Description	Building Name	Floor	Room Function	Room Number	Floor Plan
1	CMA APP MOPS	End System					
		- CMA APC	CMA APC Building	2nd Floor	Operation Room	CMA201	Attachment 6.1.2a
		Equipment					
		- Redundant Data processing	CMA APC Building	2nd Floor	Equipment Room	CMA203	Attachment 6.1.2a
		- VCCS	CMA APC Building	2nd Floor	Equipment Room	CMA203	Attachment 6.1.2a
		- F-VCCS	CMA APC Building	2nd Floor	Equipment Room	CMA203	Attachment 6.1.2a
2	CMA APP CON/TRA	End System					
		- CMA APP CON/TRA	CMA APC Building	2nd Floor	CON/TRA Room	CMA202	Attachment 6.1.2a
		- Pseudo Pilot	CMA APC Building	2nd Floor	Pilot Room	CMA202	Attachment 6.1.2a
		Equipment					
		- Data processing	CMA APC Building	2nd Floor	CON/TRA Room	CMA202	Attachment 6.1.2a
		- VCCS	CMA APC Building	2nd Floor	CON/TRA Room	CMA202	Attachment 6.1.2a
3	CMA LTS	End System					
		- CMA Local Tower	CMA APC Building	7th Floor	Local Tower Control Room	CMA701	Attachment 6.1.2a
		Equipment					
		- Redundant Data processing	CMA APC Building	2nd Floor	Equipment Room	CMA203	Attachment 6.1.2a
4	UPS	UPS #2	CMA APC Building	1st Floor	UPS Room	CMA101	Attachment 6.1.2b

Table 21 Summary of CMA APP Site Information

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6.1.3**Hat Yai Site**

The facilities at Hat yai Site related to TMCS consist of two (2) building which are The Hat Yai Approach Control Centre (HTY APC) Building and CON/TRA Building.

Attachment 6.1.3 illustrates the location of the buildings.

a) HTY APC Building

There are three (3) rooms allocated for the TMCS in the HTY APC Building.

b) Training Building

There are two (2) rooms allocated for the TMCS in the Training Building.

Each room is planned for specific operation purpose. Please be advised that, at the present, there are others equipments installed in some rooms. The site survey and site evaluation are recommended.

The following table describes the TMCS equipments and their planned installed rooms at Hat Yai Site.

	System Name	System Description	Building Name	Floor	Room Function	Room Number	Floor Plan
1	HTY APP MOPS	End System					
		- HTY APC	HTY APC Building	2 nd Floor	Interim Operation Room	HTY201	Attachment 6.1.3a
		Equipment					
		- Redundant Data processing	HTY APC Building	2 nd Floor	Equipment Room	HTY202	Attachment 6.1.3a
		- VCCS	HTY APC Building	2 nd Floor	Equipment Room	HTY202	Attachment 6.1.3a
		- F-VCCS	HTY APC Building	2 nd Floor	Equipment Room	HTY202	Attachment 6.1.3a
2	HTY APP CON/TRA	End System					
		- HTY APP CON/TRA	HTY Training Building	1 st Floor	CON/TRA Room	HTN102	Attachment 6.1.3b
		- Pseudo Pilot	HTY Training Building	1 st Floor	Pilot Room	HTN101	Attachment 6.1.3b
		Equipment					
		- Data processing	HTY Training Building	1 st Floor	Equipment Room	HTN103	Attachment 6.1.3b
		- VCCS	HTY Training Building	1 st Floor	Equipment Room	HTN103	Attachment 6.1.3b
3	HTY LTS	End System					
		- HTY Local Tower	HTY APC Building	6 th Floor	Local Tower Control Room	HTY601	Attachment 6.1.3a
		Equipment					
		- Redundant Data processing	HTY APC Building	2 nd Floor	Equipment Room	HTY202	Attachment 6.1.3a
4	UPS	UPS # 2	Training Building	1 st Floor	UPS Room	HTN104	Attachment 6.1.3b

Table 22 Summary of HTY APP Site Information

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6.1.4**Phuket Site**

The facilities at Phuket Site related to TMCS consist of two (2) building which are The Phuket Approach Control Centre (PUT APC) Building and Administrative Building.

Attachment 6.1.4 illustrates the location of the buildings.

a) PUT APC Building

There are three (3) rooms allocated for the TMCS in the PUT APC Building.

b) Administrative Building

There are three (3) rooms allocated for the TMCS in the Administrative Building.

Each room is planned for specific operation purpose. Please be advised that, at the present, there are others equipments installed in some rooms. The site survey and site evaluation are recommended.

The following table describes the TMCS equipments and their planned installed rooms at Phuket Site.

	System Name	System Description	Building Name	Floor	Room Function	Room Number	Floor Plan
1	PUT APP MOPS	End System					
		- PUT APC	PUT APC Building	1 st Floor	Operation Room	PUT101	Attachment 6.1.4a
		Equipment					
		- Redundant Data processing	PUT APC Building	1 st Floor	Equipment Room	PUT102	Attachment 6.1.4a
		- VCCS	PUT APC Building	1 st Floor	Equipment Room	PUT102	Attachment 6.1.4a
		- F-VCCS	PUT APC Building	1 st Floor	Equipment Room	PUT102	Attachment 6.1.4a
2	PUT APP CON/TRA	End System					
		- PUT APP CON/TRA	Administrative Building	2 nd Floor	CON/TRA Room	PAD201	Attachment 6.1.4b
		- Pseudo Pilot	Administrative Building	2 nd Floor	Pilot Room	PAD 202	Attachment 6.1.4b
		Equipment					
		- Data processing	Administrative Building	2 nd Floor	Equipment Room	PAD 203	Attachment 6.1.4b
		- VCCS	Administrative Building	2 nd Floor	Equipment Room	PAD 203	Attachment 6.1.4b
3	PUT LTS	End System					
		- PUT Local Tower	PUT APC Building	9 th Floor	Local Tower Control Room	PUT901	Attachment 6.1.4a
		Equipment					
		- Redundant Data processing	PUT APC Building	2 nd Floor	Equipment Room	PUT102	Attachment 6.1.4a
4	UPS	UPS # 2	Administrative Building	1 st Floor	UPS Room	PAD101	Attachment 6.1.4c

Table 23 Summary of PUT APP Site Information

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6.1.5**Phitsanulok Site**

The facilities at Phitsanulok Site related to TMCS consists of two (2) building which are The Phitsanulok Approach Control Centre (PSL APC) Building and Administrative Building.

Attachment 6.1.5 illustrates the location of the buildings.

a) PSL APC Building

There are three (3) rooms allocated for the TMCS in the PSL APC Building.

b) Administrative Building

There are three (3) rooms allocated for the TMCS in the Administrative Building.

Each room is planned for specific operation purpose. Please be advised that, at the present, there are others equipments installed in some rooms. The site survey and site evaluation are recommended.

The following table describes the TMCS equipments and their planned installed rooms at Phitsanulok Site.

	System Name	System Description	Building Name	Floor	Room Function	Room Number	Floor Plan
1	PSL APP MOPS	End System					
		- PSL APC	PSL APC Building	2 nd Floor	Operation Room	PSL201	Attachment 6.1.5a
		Equipment					
		- Redundant Data processing	PSL APC Building	2 nd Floor	Equipment Room	PSL202	Attachment 6.1.5a
		- VCCS	PSL APC Building	2 nd Floor	Equipment Room	PSL202	Attachment 6.1.5a
		- F-VCCS	PSL APC Building	2 nd Floor	Equipment Room	PSL202	Attachment 6.1.5a
2	PSL APP CON/TRA	End System					
		- PSL APP CON/TRA	Administrative Building	3 rd Floor	CON/TRA Room	ADM301	Attachment 6.1.5b
		- Pseudo Pilot	Administrative Building	3 rd Floor	Pilot Room	ADM302	Attachment 6.1.5b
		Equipment					
		- Data processing	Administrative Building	3 rd Floor	Equipment Room	ADM303	Attachment 6.1.5b
		- VCCS	Administrative Building	3 rd Floor	Equipment Room	ADM303	Attachment 6.1.5b
3	PSL LTS	End System					
		- PSL Local Tower	PSL APC Building	6 th Floor	Local Tower Control Room	PSL601	Attachment 6.1.5a
		Equipment					
		- Redundant Data processing	PSL APC Building	2 nd Floor	Equipment Room	PSL202	Attachment 6.1.5a
4	UPS	UPS # 2	Administrative Building	1 st Floor	UPS Room	ADM101	Attachment 6.1.5c

Table 24 Summary of PSL APP Site Information

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6.1.6**Hua Hin Site**

The facilities in Hua Hin Site related to TMCS consist of two (2) buildings which are Hua Hin Approach Control Centre (HHN APC) Building and Air Field Lighting Building.

Attachment 6.1.6 illustrates the location of buildings at Hua Hin APP Control Centre.

a) HHN APC Building

There are three (3) rooms allocated for TMCS in the HHN APC Building.

b) Air Field Lighting Building

There are three (3) rooms allocated for the TMCS in the Air Field Lighting Building.

Each room is planned for specific operation purpose. Please be advised that, at the present, there are others equipments installed in some rooms. The site survey and site evaluation are recommended.

The following table describes the TMCS equipments and their planned installed rooms at Hua Hin Site.

	System Name	System Description	Building Name	Floor	Room Function	Room Number	Floor Plan
1	HHN APP MOPS	End System					
		- HHN APP	HHN APC Building	6 th Floor	Operation Room	HHN601	Attachment 6.1.6a
		Equipment					
		- Redundant Data processing	HHN APC Building	7 th Floor	Equipment Room	HHN701	Attachment 6.1.6b
		- VCCS	HHN APC Building	7 th Floor	Equipment Room	HHN701	Attachment 6.1.6b
		- F-VCCS	HHN APC Building	7 th Floor	Equipment Room	HHN701	Attachment 6.1.6b
2	HHN APP CON/TRA	End System					
		- HHN APP CON/TRA	Air Field Lighting Building	1 st Floor	CON/TRA Room	AFL101	Attachment 6.1.6c
		- Psuedo Pilot	Air Field Lighting Building	1 st Floor	CON/TRA Room	AFL101	Attachment 6.1.6c
		Equipment					
		- Data processing	Air Field Lighting Building	1 st Floor	Equipment Room	AFL101	Attachment 6.1.6c
		- VCCS	Air Field Lighting Building	1 st Floor	Equipment Room	AFL101	Attachment 6.1.6c
3	HHN LTS	End System					
		- HHN Local Tower	HHN APC Building	8 th Floor	Local Tower Control Room	HHN801	Attachment 6.1.6a
		Equipment					
		- Redundant Data processing	HHN APC Building	7 th Floor	Equipment Room	HHN701	Attachment 6.1.6b
4	UPS	UPS # 2	UPS Shelter	1 st Floor	UPS Room	UPS101	Attachment 6.1.6

Table 25 Summary of HHN APP Site Information

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6.1.7 Suvarnabhumi Airport site

The site consists of three (3) buildings which are ATC Support Building, Aerodrome Control Tower, and CON/TRA Building.

Attachment 6.1.7 illustrates the location of the buildings.

a) ATC Support Building

There are three (3) rooms allocated for the TMCS in the ATC Support Building.

b) Aerodrome Control Tower

There are two (2) rooms allocated for TMCS in the Aerodrome Control Tower.

c) Emergency Building

There are four (4) rooms allocated for TMCS in the Emergency Building.

Each room is planned for specific operation purpose. Please be advised that, at the present, there are others equipments installed in some rooms. The site survey and site evaluation are recommended.

The following table describes the TMCS equipments and their planned installed rooms at Suvarnabhumi Airport Site.

	System Name	System Description	Building Name	Floor	Room Function	Room Number	Floor Plan
1	BAPP MOPS	End System					
		- BAPP	ATC Support Building	4 th Floor	Operation Room	ATC419	Attachment 6.1.7a
		Equipment					
		- Redundant Data processing	ATC Support Building	5 th Floor	Equipment Room	ATC521	Attachment 6.1.7b
		- VCCS	ATC Support Building	5 th Floor	Equipment Room	ATC521	Attachment 6.1.7b
		- F-VCCS	ATC Support Building	5 th Floor	Equipment Room	ATC521	Attachment 6.1.7b
2	BAPP CON/TRA	End System					
		- BAPP CON/TRA	Emergency Building	3 rd Floor	CON/TRA Room	EMG302	Attachment 6.1.7d
		- Psuedo Pilot	Emergency Building	3 rd Floor	Pilot Room	EMG303	Attachment 6.1.7d
		Equipment					
		- Data processing	Emergency Building	3 rd Floor	Equipment Room	EMG301	Attachment 6.1.7d
		- VCCS	Emergency Building	3 rd Floor	Equipment Room	EMG301	Attachment 6.1.7d
3	SBA LTS	End System					
		- SBA Local Tower	SBA Tower Building	T7 floor	Local Tower Control Room	TWR0T7	Attachment 6.1.7c
		Equipment					
		- Redundant Data processing	ATC Support Building	5 th Floor	Equipment Room	ATC521	Attachment 6.1.7b
4	UPS	UPS for BAPP MOPS					
		- UPS #1	ATC Support Building	2 nd Floor	UPS #1 Room	ATC210	Attachment 6.1.7e
		UPS for SBA LTS					
		- UPS #2	SBA Tower Building	1 st Floor	UPS #2 Room	TWR101	Attachment 6.1.7e
		UPS for BAPP CON/TRA					
		- UPS #3	Emergency Building	1 st Floor	UPS #3 Room	EMG101	Attachment 6.1.7e

Table 26 Summary of BAPP Site Information

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6.1.8 Remote Tower

There are thirty (30) remote towers under responsibility of AEROTHAI located at airports throughout BKK FIR and four (4) Military towers associated with TMCS

AEROTHAI may provide floor-plan for each remote tower upon request. However, site survey of each remote tower may be conducted by Tenderer.

a) List of Remote Tower

1. Don Muang Tower
2. Udon Thani Tower
3. Samui Tower
4. Nakhon Si Thammarat Tower
5. Khon Kaen Tower
6. Chiang Rai Tower
7. Ubon Ratchathani Tower
8. Krabi Tower
9. Surat Thani Tower
10. Sakon Nakhon Tower
11. Nakhon Phanom Tower
12. Nakhon Ratchasima Tower
13. Petchaboon Tower
14. Nan Tower
15. Phare Tower
16. Loei Tower
17. Buriram Tower
18. Roi Et Tower
19. Surin Tower
20. Chumphon Tower
21. Trat Tower
22. Mae Hong Son Tower
23. Lampang Tower
24. Sukhothai Tower
25. Tak Tower
26. Mae Sod Tower
27. Ranong Tower
28. Trang Tower
29. Pattani Tower
30. Narathiwat Tower

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Each remote tower has been installed with equipments for existing systems.
It will be used for installation of equipments of the new RTS.

b) List of Military Tower

1. Korat
2. Takhli
3. U-tapao
4. Kampangsan

Each military tower has been installed with equipments for existing systems.
It will be used for installation of the Military RTS.

6.1.9**Air Defense Units**

There are three (3) air defense units associated with BACC/BAPC operation which are OSCAR, BIG SHELL, and FOCAL. All equipments for air defense units will be initially installed and tested at Tung Mahamek Site. Then, the equipments will be transferred to corresponding air defense units.

6.2

Network Infrastructure

Network diagram provided for TMCS are depicted in figure xx.

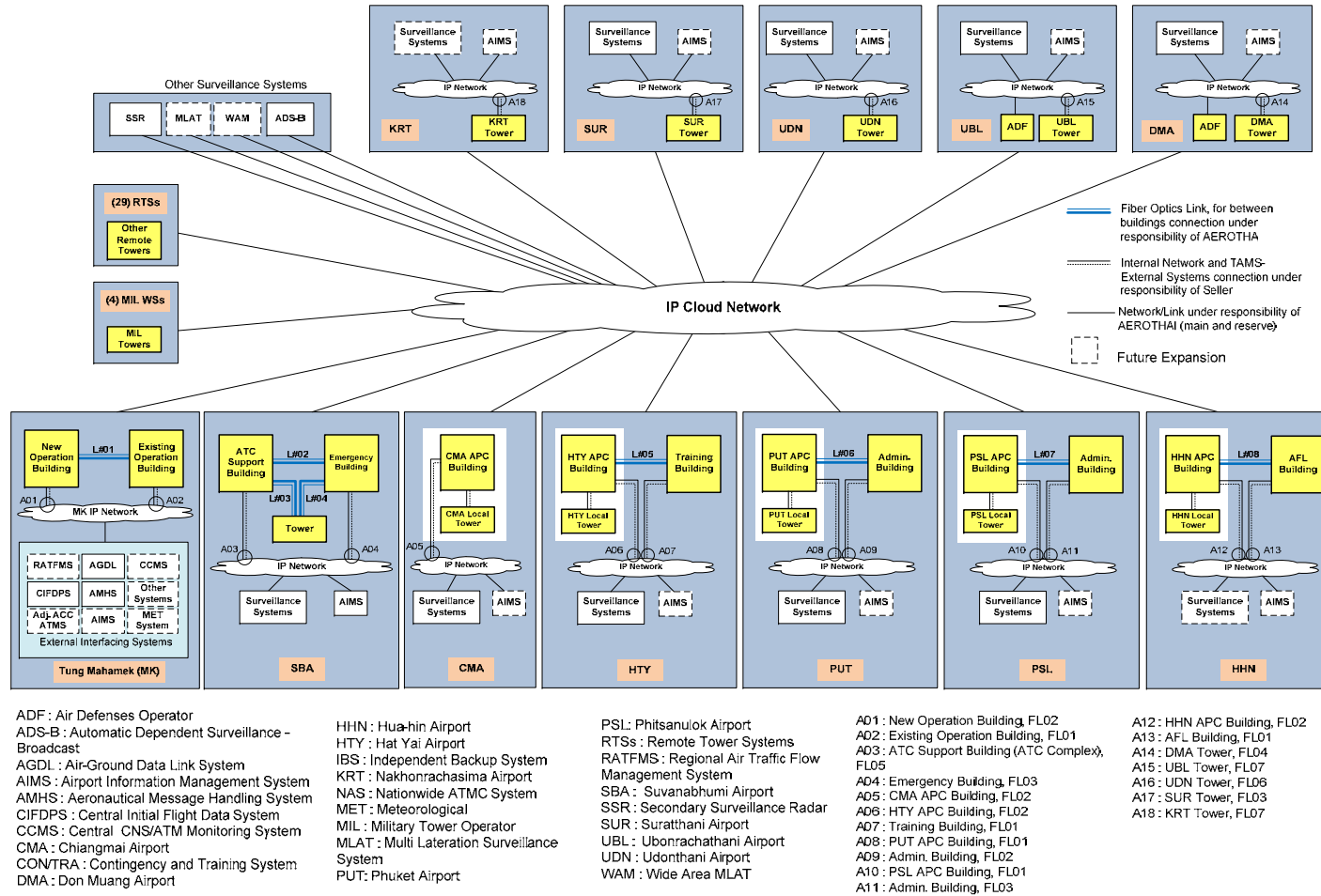


Figure 10 Network Diagram (System Capabilities Level III and IV)

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6.2.1 IP Cloud Network Equipment

From the diagram, the detailed of each connection are listed in table below. Please note that all ATS-related systems will share the same network infrastructure and bandwidth when connecting to cloud.

Site	Location of Network Equipment			Equipment Type	Network Bandwidth to/from cloud	Connector Type
	Reference Code	Building Name	Floor			
Tung Mahamek	A01	New Operation Building	2	Layer-3 Router/Switch	100 Mbps	RJ-45 10/100/1000
	A02	Existing Operation Building	1	Layer-3 Router/Switch	100 Mbps	RJ-45 10/100/1000
SBA	A03	ATC Support Building	5	Layer-3 Router/Switch	100 Mbps	RJ-45 10/100/1000
	A04	Emergency Building	3	Layer-3 Router/Switch	100 Mbps	RJ-45 10/100/1000
DMA	A14	DMA Tower	4	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
Chiang Mai Site	A05	CMA APC Building	2	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
Hat Yai Site	A06	HTY APC Building	2	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
	A07	Training Building	1	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
Phuket Site	A08	PUT APC Building	1	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
	A09	Admin. Bld.	2	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
Phitsanulok Site	A10	PSL APC Building	1	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
	A11	Admin. Bld.	3	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
Hua Hin Site	A12	Operation Bld.	5	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000
	A13	AFL Bld.	1	Layer-3 Router/Switch	10 Mbps	RJ-45 10/100/1000

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Site	Location of Network Equipment			Equipment Type	Network Bandwidth to/from cloud	Connector Type
	Reference Code	Building Name	Floor			
Ubon Ratchathani Site	A15	UBL Tower	7	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Udon Thani Site	A16	UDN Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Nakhon Ratchasima Site	A18	KRT Tower	7	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Surat Thani Site	A17	SUR Tower	3	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Other Remote Tower Sites*				Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000

Table 27 Network Connection Description

* Other Remote Tower Sites include the following towers:

Site	Location of Network Equipment on Tower (Floor)	Equipment Type	Network Bandwidth To/from cloud	Connector Type
Samui Tower	3	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Nakhon Si Thammarat Tower	5	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Khon Kaen Tower	3	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Chiang Rai Tower	3	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Krabi Tower	5	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Sakon Nakhon Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Nakhon Phanom Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Petchaboon Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Nan Tower	2	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000

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Site	Location of Network Equipment on Tower (Floor)	Equipment Type	Network Bandwidth To/from cloud	Connector Type
Phare Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Loei Tower	3	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Buriram Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Roi Et Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Surin Tower	4	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Chumphon Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Trat Tower	1	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Mae Hong Son Tower	6	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Lampang Tower	3	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Sukhothai Tower	3	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Tak Tower	3	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Mae Sod Tower	2	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Ranong Tower	5	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Trang Tower	2	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Pattani Tower	4	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000
Narathiwat Tower	5	Layer-3 Router/Switch	1 Mbps	RJ-45 10/100/1000

Table 28 Network Connection Description for Other Remote Towers

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6.2.2 Communication Media Infrastructure between buildings

From the diagram, the detailed of each communication media infrastructure between buildings are listed in table below.

Site	Reference Code	Media Type	Technical Description	Distance (Building-Building)	Bandwidth
MK	L01	Fiber Optic Cable	Single-Mode 24 core FC-Patch Panel	Approximately 200 m	100 Mbps
SBA	L02	Fiber Optic Cable	Single-Mode 12 Core FC-Patch Panel	Approximately 500 m	100 Mbps
	L03	Fiber Optic Cable	Single-Mode 6 Core FC-Patch Panel	Approximately 500 m	100 Mbps
	L04	Fiber Optic Cable	Single-Mode 6 Core FC-Patch Panel	Approximately 500 m	100 Mbps
HTY	L05	Fiber Optic Cable	Single-Mode 6 Core FC-Patch Panel	Approximately 200 m	10 Mbps
PUT	L06	Fiber Optic Cable	Single-Mode 12 Core FC-Patch Panel	Approximately 3000 m	10 Mbps
PSL	L07	Fiber Optic Cable	Single-Mode 12 Core FC-Patch Panel	Approximately 200 m	10 Mbps
HHN	L08	Fiber Optic Cable	Single-Mode 12 Core FC-Patch Panel	Approximately 100 m	10 Mbps

Table 29 Communication Media Infrastructure between buildings

7 The Planned Workstation Quantities

This section describes, in details, the quantities of workstations for all operator roles of all systems planned for the operation of TMCS. The dimension layout of workstations and operator roles are depicted in diagrams in Appendix 2.

7.1 Nationwide Air Traffic Management System (NAS):

Located at AEROTHAI Headquarter, the NAS have two systems. The planned quantities of workstations for operator role are described in table format.

7.1.1 NAS MOPS:

NAS MOPS		Workstation Quantity						
Location	Operator Role	CWS	CWS (Optional)	FDWS (Optional)	DAWS (Optional)	CMWS (Optional)	NMWS (Optional)	DSWS (Optional)
Operation Room New Operation Building	EC / PC ACC	32						
	EC / PC APP	12	8					
	AMAN ACC		3					
	AMAN APP		2					
	FISL		4					
	OPSUP	1						
	TECHSUP	1				1		
	ASM	1	1					
	TACTSUP	4	1					
	FDO			2				
Pre-tactical Operation Room New Operation Building	FMM		1					
	CMAC	1						
	FMC		3					
Equipment Room New Operation Building	DSO							1
	EO	2			1			
	MTN	2				1	1	
Total		56	23	2	1	2	1	1

Table 30 List of workstation quantities for NAS MOPS

Note: The quantities of hardware in this table under the CWS column reflects the required minimum numbers of hardware for the NAS MOPS. The quantities of hardware under the columns marked with “(optional)” are highly desirable additional numbers of hardware for the NAS MOPS.

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7.1.2 NAS CON/TRA:

NAS CON/TRA		Workstation Quantity			
Location	Operator Role	CWS	FDWS/PSPWS/TMCWS	CMWS	DSWS
CON/TRA Room Existing Operation Building	EC / PC	12			
	EC / PC APP	8			
	FISL	1			
	TECHSUP			2*	
	TMC		4		
	FDO/PSP		10		
	DSO				1
Total		21	14	2	1

* CMWS for NAS CON/TRA will be placed together with MTN or TECHSUP workstations of NAS MOPS in the operational building.

Table 31 List of workstation quantities for NAS CON/TRA

7.2 BAPP System:

Located at Suvarnabhumi Airport, the BAPP System has two systems. The planned quantities of role positions are described in table format.

7.2.1 BAPP MOPS:

BAPP MOPS		Workstation Quantity					
Location	Operator Role	CWS	FDWS	CMWS	DSWS	DAWS	NMWS
Operation Room ATC Support Building	EC / PC APP	22					
	TACTSUP	2					
	FDO		2				
Equipment Room ATC Support Building	MTN	2		1		1	1
	DSO				1		
Total		26	2	1	1	1	1

Table 32 List of workstation quantities for BAPP MOPS

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7.2.2 BAPP CON/TRA:

BAPP CON/TRA		Workstation Quantity			
Location	Operator Role	CWS	FDOWS/PSPWS/TMCWS	CMWS	DSWS
CON/TRA Operation Room Emergency Building	EC / PC APP	16			
	MTN			1	
	TMC		1		
	FDO/PSP		10		
	DSO				1
Total		16	11	1	1

Table 33 List of workstation quantities for BAPP CON/TRA

7.3 Air Defense Units

BACC/BAPC operation will exchange information with Air Defense Unit in order to coordinate. The planned quantities of role positions are described in table format

Air Defense Units		Workstation Quantity
Location	Operator Role	CWS
Big Shell	ADF	1
Oscar	ADF	1
Focal	ADF	1
Total		3

Table 34 List of workstation quantities for Air Defense Units

7.4 CMA APP System:

Located at Chiangmai airport, the CMA APP System has two systems. The planned quantities of role positions are described in table format.

7.4.1 CMA APP MOPS:

CMA APP MOPS		Workstation Quantity					
Location	Operator Role	CWS	FDWS	CMWS	DSWS	DAWS	NMWS
Operation Room	EC / PC APP	6					
	FDO		1				
CMA APC Building	AMAN	1					
	TACTSUP	1					
Equipment Room CMA APC Building	MTN / EO	2		1		1	1
	DSO				1		

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CMA APP MOPS		Workstation Quantity					
Location	Operator Role	CWS	FDWS	CMWS	DSWS	DAWS	NMWS
Total		10	1	1	1	1	1

Table 35 List of workstation quantities for CMA APP MOPS

7.4.2 CMA APP CON/TRA:

CMA APP CON/TRA		Workstation Quantity				
Location	Operator Role	CWS	FDWS/PSPWS/TMCWS	CMWS	DSWS	
CON/TRA Room CMA APC Building	EC / PC APP	4				
	MTN			2*		
	TMC		1			
	FDO/PSP		4			
	DSO					1
Total		4	5	1		1

* CMWS for CMA APP CON/TRA will be placed together with MTN workstations of CMA APP MOPS.

Table 36 List of workstation quantities for CMA APP CON/TRA

7.5 HTY APP System:

Located at Hatyai airport, the HTY APP System has two systems. The planned quantities of positions are described in table format.

7.5.1 HTY APP MOPS:

HTY APP MOPS		Workstation Quantity					
Location	Operator Role	CWS	FDWS	CMWS	DSWS	DAWS	NMWS
Operation Room HTY APC Building	EC / PC APP	6					
	FDO		1				
	AMAN	1					
	TACTSUP	1					
Equipment Room HTY APC Building	MTN / EO	2		1		1	1
	DSO				1		
Total		10	1	1	1	1	1

Table 37 List of workstation quantities for HTY APP MOPS

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7.5.2 HTY APP CON/TRA:

HTY APP CON/TRA		Workstation Quantity			
Location	Operator Role	CWS	FDWS/PSPWS/TMCWS	CMWS	DSWS
Equipment Room Training Building	EC / PC APP	4			
	MTN			2*	
	TMC		1		
	FDO		4		
	DSO				1
Total		4	5	1	1

* CMWS for HTY APP CON/TRA will be placed together with MTN workstations of HTY APP MOPS.

Table 38 List of workstation quantities for HTY APP CON/TRA

7.6 PUT APP System:

Located at Phuket airport, the PUT APP System has two systems. The planned quantities of positions are described in table format.

7.6.1 PUT APP MOPS:

PUT APP MOPS		Workstation Quantity					
Location	Operator Role	CWS	FDWS	CMWS	DSWS	DAWS	NMWS
Operation Room PUT APC Building	EC / PC APP	6					
	FDO		1				
	AMAN	1					
	TACTSUP	1					
Equipment Room PUT APC Building	MTN / EO	2		1		1	1
	DSO				1		
Total		10	1	1	1	1	1

Table 39 List of workstation quantities for PUT APP MOPS

7.6.2 PUT APP CON/TRA:

PUT APP CON/TRA		Workstation Quantity			
Location	Operator Role	CWS	FDWS/PSPWS/TMCWS	CMWS	DSWS
CON/TRA Room Administrative Building	EC / PC APP	4			
	MTN			2*	
	TMC		1		
	FDO		4		
	DSO				1

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Total		4	5	1	1
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* CMWS for PUT APP CON/TRA will be placed together with MTN workstations of PUT APP MOPS.

Table 40 List of workstation quantities for PUT APP CON/TRA

7.7 PSL APP System:

Located at Phitsanulok airport, the PSL APP System has two systems. The planned quantities of positions are described in table format.

7.7.1 PSL APP MOPS:

PSL APP MOPS		Workstation Quantity					
Location	Operator Role	CWS	FDWS	CMWS	DSWS	DAWS	NMWS
Operation Room PSL APC Building	EC / PC APP	4					
	FDO		1				
	TACTSUP	1					
Equipment Room PSL APC Building	MTN / EO	2		1		1	1
	DSO				1		
Total		7	1	1	1	1	1

Table 41 List of workstation quantities for PSL APP MOPS

7.7.2 PSL APP CON/TRA:

PSL APP CON/TRA		Workstation Quantity			
Location	Operator Role	CWS	FDWS/PSPWS/TMCWS	CMWS	DSWS
CON/TRA Room Administrative Building	EC / PC APP	4			
	MTN			2*	
	TMC		1		
	FDO		4		
	DSO				1
Total		4	5	1	1

* CMWS for PSL APP CON/TRA will be placed together with MTN workstations of PSL APP MOPS.

Table 42 List of workstation quantities for PSL APP CON/TRA

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7.8 HHN APP System:

Located at Hua Hin airport, the HHN APP System has two systems. The planned quantities of positions are described in table format.

7.8.1 HHN APP MOPS:

HHN APP MOPS		Workstation Quantity					
Location	Operator Role	CWS	FDWS	CMWS	DSWS	DAWS	NMWS
Operation Room HHN APC Building	EC / PC APP	4					
	FDO		1				
	TACTSUP	1					
Equipment Room HHN APC Building	MTN / EO	2		1		1	1
	DSO				1		
Total		7	1	1	1	1	1

Table 43 List of workstation quantities for HHN APP MOPS

7.8.2 HHN APP CON/TRA:

HHN APP CON/TRA		Workstation Quantity			
Location	Operator Role	CWS	FDWS/PSPWS/TMCWS	CMWS	DSWS
CON/TRA Room Air Field Lighting Building	EC / PC APP	4			
	MTN			2*	
	TMC		1		
	FDO		4		
	DSO				1
Total		4	5	1	1

* CMWS for HHN APP CON/TRA will be placed together with MTN workstations of HHN APP MOPS.

Table 44 List of workstation quantities for HHN APP CON/TRA

7.9 Tower System:

The towers across BKK FIR are categorized into 4 categories as follow:

7.9.1 Level-I Tower System

The planned quantities of positions of each level-I tower system are described in table format:

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Level-I Tower System	Workstation Quantities (Set)
Operator Role	MIL
Military Tower Operator	1

Table 45 List of workstation quantities for Level-1 Tower System

7.9.2 Level-II Tower System

The planned quantities of positions of each level-II tower system are described in table format:

Level-II Tower System	Workstation Quantity						
Operator Role	ASD WS	ASDWS (Optional)	GSD WS	GSDWS (Optional)	FDD WS	FDDWS (Optional)	T-CMS (Optional)
LCL	1		1		1		
GND			1		1		
COR		1		1		1	
T-FDO						1	
T-MTN							1
Total	1	1	2	1	2	2	1

Table 46 List of workstation quantities for Level-II Tower System

Note: The quantities of hardware in this table under the ASD, GSD, FDD column reflects the minimum numbers of hardware for the Tower System. The quantities of hardware under the columns marked with “(optional)” are desirable additional numbers of hardware for the Tower System.

7.9.3 Level-III Tower System

The planned quantities of positions of each level-III tower system are described in table format:

Level-III Tower System	Workstation Quantity				
Operator Role	ASDWS	GSDWS	FDDWS	FDDWS (Optional)	T-CMS (Optional)
LCL	1	1	1		

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Level-III Tower System	Workstation Quantity				
Operator Role	ASDWS	GSDWS	FDDWS	FDDWS (Optional)	T-CMS (Optional)
GND		1	1		
COR	1	1	1		
T-FDO				1	
T-MTN					1
Total	2	3	3	1	1

Table 47 List of workstation quantities for Level-III Tower System

Note: The quantities of hardware in this table under the ASD, GSD, FDD column reflects the minimum numbers of hardware for the Tower System. The quantities of hardware under the columns marked with “(optional)” are desirable additional numbers of hardware for the Tower System.

7.9.4 Level-IV Tower System

There are two (2) tower systems within this level. Their respective planned quantities of positions are separately described due to their uniqueness.

- a) Suvarnabhumi International Airport (SBA) Tower System: SBA Tower System comprises of 2 systems.
 - SBA LTS: The planned quantities of positions are described in table format:

SBA LTS		Workstation Quantity				
Location	Operator Role	ASDWS	GSDWS	FDDWS	T-CMS	T-DSO
SVB Airport Control Tower	LCL	3	3	3		
	GND		4	4		
	CDC		2	2		
	T-FDO			4		
	T-TACTSUP	1	1	1		
5th Floor Equipment room	T-MTN	1	1	1	1	
	T-EO	1	1	1		
	T-DSO					1

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SBA LTS		Workstation Quantity				
Location	Operator Role	ASDWS	GSDWS	FDDWS	T-CMS	T-DSO
4th Floor ATC Complex	Information Sets	8	9	3		
ARO Office	ARO			1		
AOT Office	BAO			1		
Total		14	21	21	1	1

Table 48 List of workstation quantities for Level-IV - SBA LTS

- SBA Emergency Tower System: The planned quantities of positions are described in table format:

SBA Emergency Tower System		Workstation Quantity		
Location	Operator Role	ASDWS	GSDWS	FDDWS
West Apron	LCL	2	2	2
	GND		2	2
	T-TACTSUP	1	1	1
	T-FDO			2
	CDC		2	2
East Apron	LCL	1	1	1
	GND		2	2
	T-FDO			2
Total		4	10	14

Table 49 List of workstation quantities for Level-IV - SBA Emergency Tower System

- b) Don Muang Airport (DMA) Remote Tower System (RTS): DMA Tower System comprises 2 systems.
- DMA Tower System: The planned quantities of positions are described in table format:

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DMA RTS		Workstation Quantity				
Location	Operator Role	ASDWS	GSDWS	FDDWS	T-CMS	T-DSO
DMA Tower	LCL	1	1	1		
	GND		2	2		
	T-FDO / CDC			2		
	DMAN			1		
	T-TACTSUP	1	1	1		
Equipment Room	T-MTN	1	1	1	1	
	T-DSO					1
	T-EO	1	1	1		
ARO Office	ARO			1		
AOT Office	BAO (AOT)			2		
	FAO (AOT)			1		
Total		4	6	13	1	1

Table 50 List of workstation quantities for Level-IV - DMA RTS

- DMA Emergency Tower System: The planned quantities of positions are described in table format:

DMA Emergency Tower System		Workstation Quantity		
Location	Operator Role	ASDWS	GSDWS	FDDWS
DMA APRON TOWER	LCL	1	1	1
	GND		1	1
	T-FDO / CDC			1
	T-TACTSUP	1	1	1
Total		2	3	4

Table 51 List of workstation quantities for Level-IV - DMA Emergency Tower System

7.10 Additional requirements for workstations:

7.10.1 Optional workstations:

The TMCS will be designed to support the following optional End Systems without software modification:

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- a) The BACC/BAPC NAS can accommodate the concurrent operation of additional 30 End Systems as listed below:
- EC / PC APP can be accommodated with optional 8 CWS.
 - AMAN ACC can be accommodated with optional 3 CWS.
 - AMAN APP can be accommodated with optional 2 CWS.
 - FISL can be accommodated with optional 4 CWS.
 - TECHSUP can be accommodated with additional 1 CMWS
 - ASM can be accommodated with optional 1 CWS.
 - TACTSUP can be accommodated with optional 1 CWS.
 - FDO can be accommodated with optional 2 FDWS.
 - FMM can be accommodated with optional 1 CWS.
 - FMC can be accommodated with optional 3 CWS.
 - DSO can be accommodated with optional 1 DSWS.
 - EO can be accommodated with optional 1 DAWS.
 - MTN can be accommodated with optional 1 CMWS and optional 1 NMWS.
- b) The BACC/BAPC NAS will be provided with the appropriate software for the previously mentioned additional 30 End Systems. Only hardware and suitable operating system will be needed in order to expand the BACC/BAPC NAS for optional End Systems.
- c) The BACC/BAPC NAS will be provided with appropriate network infrastructure including network equipment, cable and wiring, and installation for the previously mentioned additional 30 End Systems. Only hardware will be needed in order to expand the BACC/BAPC NAS for optional End Systems.
- d) The Level-II Tower System can accommodate the concurrent operation of additional 5 End Systems as listed below:
- COR can be accommodated with optional 1 ASDWS, optional 1 GSDWS and optional 1 FDDWS.

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- T-FDO can be accommodated with optional 1 FDDWS.
 - T-MTN can be accommodated with optional 1 T-CMS.
- e) The Level-II Tower System will be provided with the appropriate software for the previously mentioned additional 5 End Systems. Only hardware and suitable operating system will be needed in order to expand the Level-II Tower System for optional End Systems.
- f) The Level-II Tower System will be provided with appropriate network infrastructure including network equipment, cable and wiring, and installation for the previously mentioned additional 5 End Systems. Only hardware will be needed in order to expand the Level-II Tower System for optional End Systems.
- g) The Level-III Tower System can accommodate the concurrent operation of additional 2 End Systems as listed below:
 - T-FDO can be accommodated with optional 1 FDDWS.
 - T-MTN can be accommodated with optional 1 T-CMS.
- h) The Level-III Tower System will be provided with the appropriate software for the previously mentioned additional 2 End Systems. Only hardware and suitable operating system will be needed in order to expand the Level-III Tower System for optional End Systems.
- i) The Level-III Tower System will be provided with appropriate network infrastructure including network equipment, cable and wiring, and installation for the previously mentioned additional 2 End Systems. Only hardware will be needed in order to expand the Level-III Tower System for optional End Systems.

7.10.2**Future Expansion:**

The TMCS will expand in the future, therefore, the system will be designed to support the following expansion capacity using hardware upgrade without software modification:

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The BACC/BAPC NAS can accommodate the concurrent operation of additional 52 workstations as listed below:

- EC / PC ACC can be expanded with additional 32 CWS.
- EC / PC APP can be expanded with additional 20 CWS.

BAPP can accommodate the concurrent operation of additional 24 workstations as listed below:

- EC / PC APP can be further expanded with additional 24 CWS.

The CMA APP System can accommodate the concurrent operation of additional 6 workstations as listed below:

- EC / PC APP can be further expanded with additional 6 CWS.

The HTY APP System can accommodate the concurrent operation of additional 6 workstations as listed below:

- EC / PC APP can be further expanded with additional 6 CWS.

The PUT APP System can accommodate the concurrent operation of additional 6 workstations as listed below:

- EC / PC APP can be further expanded with additional 6 CWS.

The PSL APP System can accommodate the concurrent operation of additional 4 workstations as listed below:

- EC / PC APP can be further expanded with additional 4 CWS.

The HHN APP System can accommodate the concurrent operation of additional 4 workstations as listed below.

- EC / PC APP can be further expanded with additional 4 CWS.

The NAS IBS can accommodate the concurrent operation of workstations as listed in the table below.

NAS IBS		Workstation Quantity					
Location	Operator Role	CWS	FDWS	DAWS	CMWS	NMWS	DSWS
TBD	EC / PC ACC	32					
	EC / PC APP	20					
	AMAN ACC	3					

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	AMAN APP	2					
	FISL	4					
	OPSUP	1					
	TECHSUP	1			1		
	ASM	2					
	TACTSUP	5					
	FDO		2				
	DSO						2
	EO	2		1			
	FMM	1					
	CMAC	1					
	FMC	3					
	MTN	2			1	1	
Total		79	2	1	2	1	2

Table 52 Workstation Quantities of NAS IBS

The APP IBS can accommodate the concurrent operation of workstations as listed in the table below.

APP IBS		Workstation Quantity			
Location	Operator Role	CWS	FDWS	CMWS	DSWS
TBD	EC / PC APP	12			
	EC APP	10			
	TACTSUP	2			
	FDO		2		
	MTN	2			
	TECH			1	
	DSO				1
Total		26	2	1	1

Table 53 Workstation Quantities of APP IBS

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8 The Voice Communication and Control System (VCCS)

The Voice Communication and Control System (VCCS) is an integrated component of MOPS and CON/TRA. It enables ground-ground communication between NAS, APP System, RTS, LTS and neighboring ATS units and air-ground communications between air traffic controllers and pilots.

The VCCS for NAS and each APP System compose of:

- MOPS VCCS is used in normal operation.
- Fallback VCCS is used when the MOPS VCCS is not applicable. The interfacing capacity of the Fallback VCCS is the same as MOPS VCCS.
- CON/TRA VCCS (contingency and training VCCS) is used for training purpose in normal situation and used in contingency mode when the MOPS VCCS and Fallback VCCS are not applicable.

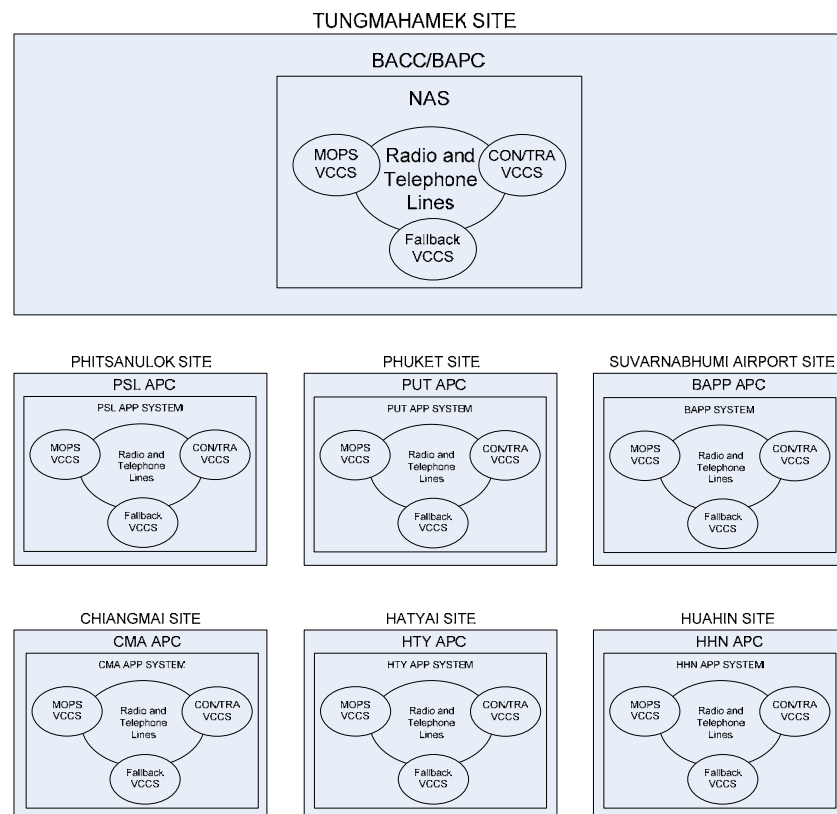


Figure 11 VCCS composition at each site

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The radio and telephone lines at each site are connected to all VCCS (Main, Fallback and CON/TRA VCCS). There is an input control system to manage (select) the suitable radio and telephone lines to the Main, Fallback and CON/TRA VCCS according to the situation and mode of operation.

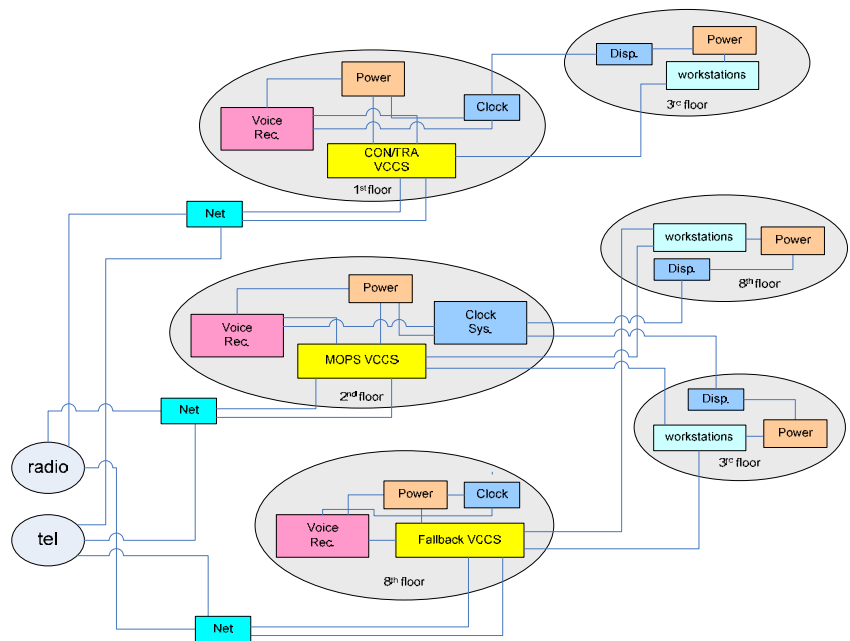


Figure 12 VCCS Composition of NAS.

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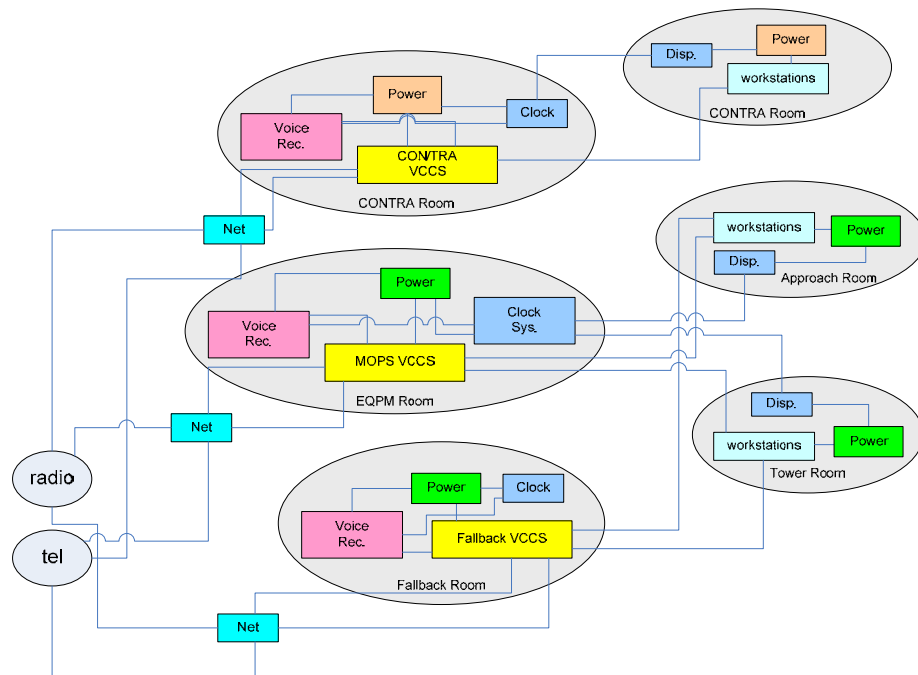


Figure 13 VCCS Composition of APP System

The system has built-in redundancy on vital parts, have a distributed, decentralized, processing, modular design and be free from single-point-of-failures. And for safety reason, the interconnection between central racks and VCCS workstation facilities should use star topology. A tested and operationally proven “off-the-shelf” system is preferred to avoid new costly developments and risk of delays. It has a high availability and be fully re-configurable and was fitted with interface for external alarm connections.

8.1 VCCS Workstation Facilities

Each user interfaces with the VCCS through VCCS workstation facilities which provide a means of communication for both ground-ground and air-ground applications. The VCCS workstation facilities use a range of activation, presentation and audio devices to provide access to all of the user functions implemented by a VCCS. These devices are included, but are not limited to:

- Touch Entry Device Panel (TED panel)
- Headset/Handset

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- Loudspeakers
- Push-to-talk (PTT) switch
- Slave Clock Display

HMI for operators is user-friendly and preferably TED panel with the appropriate size, easy to read out by the operators. The TED panel is a single unit with its own processor included and not requires any external personal computer hardware. Headsets and handsets at the VCCS workstation facility consists of a microphone, ear-cap and PTT switch and identical plugs will be used for headsets and handsets. Each VCCS workstation facility has two loudspeakers one for air-ground and another one for ground-ground and each position is equipped with a slave clock display and a foot switch.

8.2 Radio Part

The VCCS use radio line interface module (RLIM) to interface with radio transmitter, radio receiver both local and remote stations which interface with the analog and digital format such as E1/VoIP. In operation, the RLIM will automatically mute the receiver when the transmitter is transmitting. The amplifiers of the RLIM are adjustable both in transmitting and receiving directions. For safety reason, not more than 2 radio lines are connected to one RLIM and the main/standby transmitter and receiver have their own channeling throughout.

The delay time of RLIM (transmit, receive and PTT signal) need to be adjustable independently of other lines due to different media using interface to the radio equipment. And the delay time will be adjustable in the range 0 to 1000 ms (or more) in step of 1ms.

For the purpose of training, supervisory and traffic tracking, any VCCS workstation facility will have the capability to monitor all radio traffic on lines that are available at the VCCS workstation facility, even if they have been selected at other VCCS workstation facilities.

8.3 Telephone Part

The VCCS use telephone line interface module (TLIM) to interface with telephone lines. The TLIM support a full range of digital and analogue interfaces for local, regional, national and international access to communications resources such as 2-Wire Telephone Set, 2-Wire Voice Call and 2-Wire Public Switched Telephone

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Network (PSTN)/Private Automatic Branch Exchange (PABX), VoIP etc. The amplifiers of TLIMs are adjustable both in transmitting and receiving directions. And for safety reason, not more than 2 telephone lines are connected to one TLIM.

8.4 Technical Control Unit (TCU)

The Technical Control Unit (TCU) is used for monitoring and configuration of the VCCS central racks. Generally, the TCU is composed of a personal computer equipped with a display, a keyboard, a mouse, a loading device, a color laser printer and software. There are 2 (two) set of TCUs, one is installed at equipment room and another one is installed at control room (TECHSUP position.) When the TCU application program is started up, the operator needs to enter his/her login name and a password. The TCU software includes facilities to record an event log, statistical package data for recorded traffic load in individual VCCS workstation facility, telephone lines, and radio lines. To make online reconfiguration, different configurations will be pre-programmed and called up from the TCU by way of menus. The online reconfiguration for each VCCS workstation facility should not affect the other VCCS workstation facility operation and should not require reboot of the whole system. Furthermore, the online reconfiguration will stay after the whole system is rebooted. And when VCCS malfunction is detected, the TCU will raise visual and audible alarm.

8.5 Radio Function

The VCCS has air-ground radio line selection and operation. Receivers and transmitters (main and standby channels) can be selected/deselected by touching the RX buttons and the TX buttons and VCCS will show the status of radio lines i.e. "busy state", "squellch" etc. on the TED panel. The main and standby channels of radio (transmitter) are interlock so that only one of the channels can transmit at a time even if both channels have been inadvertently selected by the controller. When more than one radio lines are selected, the operator is able to transmit at the same time on all the lines by only pushing the PTT switch. Inadvertently when frequencies in TX or RX modes are active and when the call is being received at the same time, air ground audio will automatically be routed to loudspeaker. It will be possible to configure whether only outgoing transmission will be transmitted to the active call in addition to frequencies in TX mode when PTT is pressed. For safety reason, audio level of loudspeaker will be adjustable by the volume control and with the volume control in a minimum position; the audio level will remain sufficiently audible for monitoring purpose.

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Because there are many radio frequencies and radio stations in a controlled sector, the operators can access more than one (normally at least 8) radio lines simultaneously for transmission and reception by way of loudspeaker or headset/handset or both. Receiver Voting function (Best Signal Selection) which is evaluated by signal-to-noise ratio will be used to automatically select a receiver with the best quality of signal within a group of minimum of 6 receivers. While the Receiver Voting function is in operation the operators can manually select a receiver of their choice. Automatic selection of transmitter function will be workable together with Receiver Voting function and the operators can switch to manual selection whenever needed.

Each analog radio frequency interfacing of all VCCS (MOPS, Fallback and CON/TRA) at BACC/BAPC connects to 2 local radio stations and 3 remote radio stations. The local radio stations use AEROTHAI core optical fiber links connecting to the VCCS. The voice multiplexers of these links are equipped with “connect and not connect” status signals and has an alarm signals both link and line level to show at the TCU and other remote locations.

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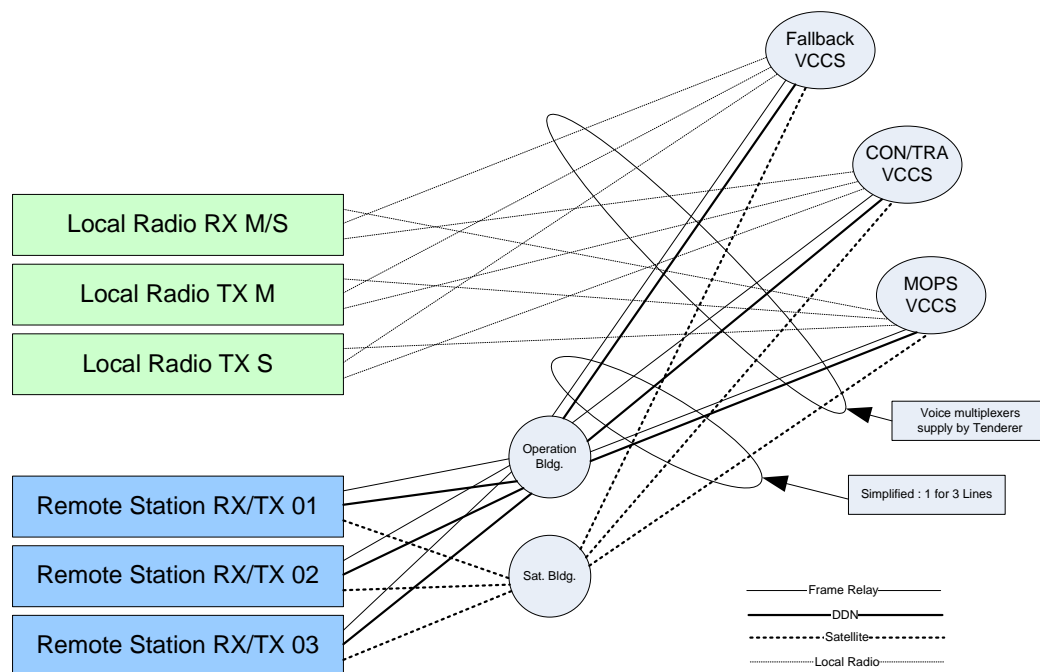


Figure 14 Simplified Configuration of Local and Remote Radio Stations for NAS

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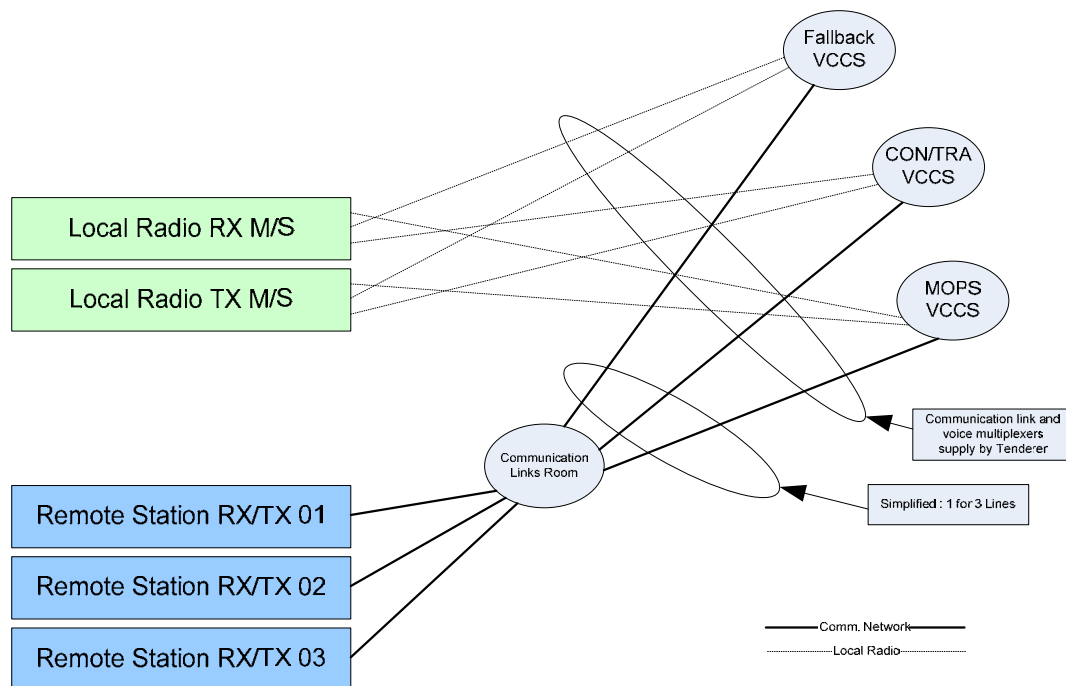


Figure 15 Simplified Configuration of Local and Remote Radio Stations for APP System.

A remote station uses three (3) communication media: digital Data Network (DDN), satellite and frame relay which have the different time delay. There is only one RX and TX buttons set for each remote radio station on the TED panel, the VCCS use one of three communication media at a time by automatic/manual media selection function. After the VCCS choose one of three communication media from each remote radio station, the receiver voting function will be use to select only one of three remote radio station to the user.

8.6 Telephone Function

There are two types of telephone calls that can be made by telephone buttons, Direct Access (DA) and Indirect Access (IA). Function buttons such as hold, conference and transfer, etc. are separated from the telephone buttons. The status of telephone lines i.e. "busy state", "call in" etc. are shown on the TED panel and after establishing a DA and IA connection and prior to the acceptance of the call by the called terminal, a ring-back tone is sent to the calling user.

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The DA and IA disconnection will automatically occur when either party terminates a two party communication. All incoming calls of the telephone lines are disabled/enabled to announce by means of signaling tone from a buzzer. It is able to switch off the signaling tone, but a visual indication "buzzer off" on the allocated button is necessary. It is also possible to adjust the signaling tone level.

The Hold, Conference and Transfer function are available for DA and IA. Each VCCS workstation facility is able to communicate with another position by selecting a button on the TED panel and directly connect to the predetermined VCCS workstation facility (Intercom.) The VCCS workstation facilities are able to communicate together by selecting the designated button on the TED panel and then calling by voice, without the need for signaling (Voice Page).

8.7 Other Functions

There is Short Time (or Term) Recording function on the TED panel for each VCCS workstation facility. The Short Time (or Term) Recording function has a minimum duration of at least 30 minutes for each VCCS workstation facility.

According to ICAO ANNEX11, each VCCS workstation facility should be equipped with ambient noise recording facility, capable of retaining the information recorded during at least the last twenty-four hours of operation.

8.8 GPS Master Clock

The GPS master clock has a time display on the front panel, automatically operated without GPS receiver and it is synchronized automatically when reconnected to the GPS receiver. The output of GPS master clock is synchronized with voice recorder or other master clocks. All slave clocks timing signal at the VCCS workstation facility is synchronized with the GPS master clock and display on each VCCS workstation facility. Also all slave clocks automatically operate without synchronization with GPS master clock and are synchronized automatically when reconnected to the GPS master clock. Slave clocks should be placed in a comfortable and easy to read position.

8.9 Power Supply

Power supply of the central racks is fed from 3 sources, 2 AC and 1 DC. A duplicated power supply for each rack is used which will interface with a 210 – 230 VAC 50 - 60 Hz (ac power). Each unit of the duplicated power supply has AC input power supplies and it has the capacity to feed the complete System. The DC input power

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operates using the provided float charged batteries system and connects directly to the equipments in central racks. When both AC power supplies fail, the DC input power has the capacity to feed the complete System for a minimum of 4 hours without any interruption to the operation of the systems.

The input power of VCCS workstation facilities such as TED panel, slave clock, etc. and interfacing communication equipments in Operation Rooms and Tower Control Rooms have two sources, AC/AC or AC/DC or DC/DC power. In the event of a power source failure, all the systems will automatically switch over to another power source without any interruption to the operation of the systems. There are two DC input power systems for each Operation Room and Tower Control Room. Each DC input power system has the capacity to feed half of VCCS workstation facilities in each room for a minimum of 4 hours without any interruption to the operation of the systems. The VCCS workstation facilities will be configured such that both DC inputs connect to VCCS workstation facilities alternately. For example, if VCCS workstation facility in a console connects to DC input 1, then the VCCS workstation facility in the next console connects to DC input 2.

(Remark: Interfacing communication equipment, such as multiplexer, optical fiber modem and so on is an interface between equipment racks and VCCS workstation facilities or remote stations.)

8.10 Cabling and Interfacing System

The VCCS central racks is interfaced with a main distribution frame (MDF) where all necessary communications are connected and lightning protection is equipped for all radio and telephone lines at the MDF. All radio and telephone lines are connected to the proposed systems and such connection will be performed at a time advised by AEROTHAI.

The input/output of any VCCS workstation facility voice signal of both telephone and radio communication is connected for recording to the proposed Digital Voice Recorder & Replay System (DVR) (Position Record). The input/output of any interfaces voice signal of both telephone and radio interfaces is connected for recording to the proposed DVR (Lines Record.)

8.11 Fallback VCCS

The role of the Fallback VCCS is to take over the ground-ground and air-ground communications in case of total failure of the MOPS VCCS. However all

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components are independent and separated from the MOPS VCCS as much as possible including a separate power supply. The Fallback VCCS has the same capability and external radio/telephone line interfaces as the MOPS VCCS excluding the VCCS workstation facilities. The central racks of the Fallback VCCS are installed in a different room as the MOPS VCCS with cables lay on separate cable ladders apart from MOPS VCCS cables. The Fallback VCCS has separate radio fallback line distribution connected to radio lines. There is a telephone fallback system directly connected to a separate telephone switching system. The VCCS workstation facilities can be shared with the MOPS VCCS.

8.12 CON/TRA VCCS

The role of the CON/TRA VCCS is to take over the ground-ground and air-ground communications in case of total failure of the MOPS VCCS and Fallback VCCS. All components are independent and separated from the MOPS VCCS and Fallback VCCS including a separate power supply. Compare to MOPS VCCS, the CON/TRA VCCS has the capability; VCCS workstation facilities and external radio/telephone line interfaces only to serve in Contingency situation. The central racks of the CON/TRA VCCS are installed in a different location as the MOPS VCCS. The CON/TRA VCCS has separate radio line distribution connected to radio lines. There is a telephone system directly connected to a separate telephone switching system. The VCCS workstation facilities are the same as the MOPS VCCS.

8.13 System Capacity

- The VCCS workstation facilities capacity of each site is specified in the VCCS Appendix 3.1 and the TLIMs for each site for interface with 2-Wire telephone set, 2-Wire Voice Call, PSTN and PABX as specified in the VCCS Appendix 3.2.
- The capacity of the 4-Wire RLIMs are specified in the VCCS Appendix 3.3.
- The capacity of the E1 RLIM for MOPS, Fallback and CON/TRA VCCS at BACC/BAPC will be, at minimum, 100 channels for each VCCS.
- The capacity of the VoIP RLIM for MOPS, Fallback and CON/TRA VCCS at BACC/BAPC will be, at minimum, 100 channels for each VCCS.
- Each position equips with Headset and handset and the existing headsets and handsets are modified to use with the proposed system are specified in the VCCS Appendix 3.4.

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- Each site supply with initial spare parts, generally at least 10% of cards or modules of the system which itemized lists of initial spare parts including the quantity suggested for each spare part against the total quantity of each system in use.
- Each site supply with technical manuals, 2 Sets of hard copy and 2 sets of soft copy and the technical manuals for complete installation, operation and maintenance instructions.

8.14 Digital Voice Recorder & Replay System (DVR)

The recording of all operational communications is mandated by ICAO. Sufficient additional information is recorded to ensure that date and time can be determined at any point in the recording. It has enough capacity to record also position ambient noise as per ICAO recommendation. Furthermore, ICAO recommends that thirty (30) days of data, at minimum, will be recorded. The Digital Voice Recorder & Replay System (DVR) is digital and comprise of a complete recorder units and replay unit with enhanced functionality in order to increase safety, efficiency and save operator time.

The DVR's time will synchronize with the VCCS GPS master clock using NTP.

For reliability reasons, DVR consist of two independent recorder units with a switchover function. The two independent recorder units can also be configured to run in parallel. A separate replay unit is included and preferably it is installed in a separate room. The recorder unit allows simultaneous recording of all operational voice communications when used operationally. All desk mounted loudspeakers, microphones, headsets and handsets are recorded. It is possible to synchronize the DVR with the corresponding Radar recordings to allow simultaneous replay. A user friendly replay is included for accurate synchronous replay of radar data, along with any other recorded data including audio. System capacity has the capability of at least 31 days storage on short-term media. All data are time stamped when stored. The DVR is fitted with an interface allowing for external alarm connections.

8.14.1 Recorder Units

The recorder unit is a duplex analogue audio multi-channels recorder which is pre-wired for and allows an expansion to increase duplex channels in the future. The recording channels capacity of each site is specified in the VCCS Appendix 3.5. The operating functions of the recording system are performed with the use

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of computer driven menus. Recording during silent periods is not required, but guarantee the actual duration of silence between periods of activity to be recovered during replay, without any loss of information.

For the recording function, at least date and time of recording is provided. The recorder units consist of two media types: short term media and archival media. The short-term media allow replays at the recorder unit to be made of recent events. It also allows simultaneous recording and replay, and is intended to provide immediate access (within 1 minute of replay initiation) to operational recordings made up to 31 days as stated previously.

The archival media is intended for long term retention. The media contains only voice recordings with the necessary time stamps. The system permits the retrieval of recorded data for the purposes of playback or data extraction without interrupting the recording process. It is possible to listen to an individual channel and to switch a number of channels, at least four (4), to a common loudspeaker for monitoring. The selection and de-selection of individual channels is possible per channel. To guarantee the continuity of recording, an automatic system incorporated in each recorder is checking continuously the performance of power supplies and run-out of recording capacity.

The archival media is recorded simultaneously with the short-term, and is for off line replays. Generally, the system permits recording over a 48 hour period for the archive media without necessitating any operator involvement (for changing media, etc.)

Remote indication of alarms for Recorder Unit is possible. In case of switchover function, the alarms consist of 2 classes: class A - this type of alarm is given at any loss of redundancy without switchover to the second unit; and class B - this type of alarm is given when a switchover to the second unit occurs. In case of parallel running, an alarm is given when any of the recorder unit fails.

8.14.2**Replay Units**

The Replay units are connected to the recorder units through network interface for remote operation purpose such as Start, Stop and Channel selection for monitoring and automatic search. A replay at variable speed is possible without losing speech intelligence and it is possible to perform replays of recordings held on the short term media to a dedicated replay stations. Channel selection, random

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access, by the input of time of day is possible. The replay of simultaneous duplex channels can support one (1) to four (4) channels or higher.

The Tenderer will provide, at minimum, two (2) Replay units per duplicated Recorder units.

At the replay units, an audio output is enabling to allow duplicate recordings to be made of replayed events on the standard analogue recording equipment. The replay unit is available with any other type of control (such as control from Replay feature (REP) of the Recording and Replay function (REC/REP)) for start, stop, pause, resume, play and reverse running of the recording media. It is able to synchronize the voice recordings with the corresponding output from the REP and other relevant recordings, to allow simultaneous replay on the dedicated replay unit at variable speed.

The replay units are also possible to replay archival media independently without connecting to the recording unit. For investigations of non-intelligible information, immediate selection of any recording, pitch interval controller feature and variable playback speed are possible.

8.14.3 DVR Supervisor Units

The DVR is supervised and operated from a centrally placed DVR supervisor unit connected to the equipment through a standard serial or network interface. The DVR supervisor unit has all system management facilities, including short-term media, and archival media management and appropriate indications of alarm conditions. Playback operations and parameter settings are possible to do from the DVR supervisor unit. A HMI is also enabled from the software running at the DVR supervisor unit. And when DVR malfunction is detected, the DVR supervisor unit will raise both visual and audible alarms.

8.14.4 Power Supply

The recorder units and DVR supervisor unit use 2 sources of power supply: 2 AC. A duplicated power supply for each recorder is used which interface with a 210 – 230 VAC 50 - 60 Hz (ac power). Each unit of the duplicated power supply has AC input power supply and it has the capacity to feed the complete system. In the event of a power source failure, the recorder units and DVR supervisor unit are able to use another power source without any interruption to the operation of the systems.

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8.14.5 Fallback and CON/TRA Voice Recorder

The Fallback and CON/TRA DVR requirement are the same as for the Main DVR but installed in the different locations (Fallback VCCS equipment room and CON/TRA VCCS equipment room.)

9 System Functionalities

This section describes the minimum system functionalities and system capabilities of the TMCS. The system functionalities and system capabilities of the TMCS have been arranged into seven (7) groups following the TMCS' system architecture as follow: NAS, NAS IBS, APP IBS, BAPP System, APP Systems, LTS, and RTS.

Figure 16 displays the breakdown of all system functionalities and system capabilities in which their details are described in the following subparagraphs.

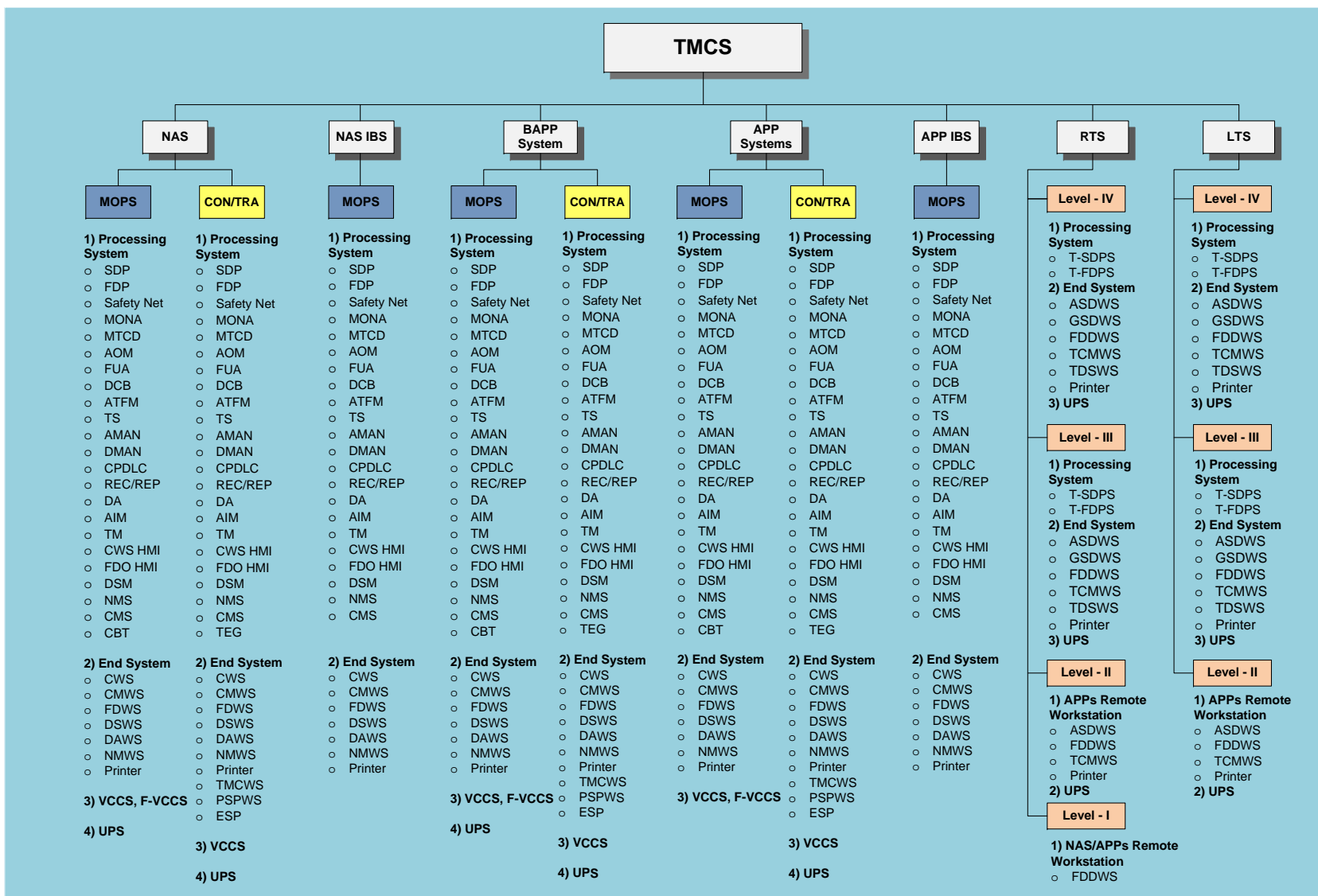


Figure 16 The Breakdown of TMCS Feature

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9.1 Surveillance Data Processing

The surveillance messages from surveillance sensors should be a vital input data of the TMCS. Such surveillance messages should be managed and processed in order to support functions for Air Traffic Controller (ATC) operation such as situational awareness, flight data update, ATC tools (e.g. Safety Nets, Monitoring Aids, Medium Term Conflict Detection) etc.

There are many types of surveillance technologies in the market such as PSR, SSR (Mode A/C and Mode-S), ADS-B and MLAT/WAM which AEROTHAI currently deploys some of them. These surveillance sensors may have different data format as well. Therefore, AEROTHAI expected that the TMCS should be able to process surveillance messages from every surveillance technology in the next ten (10) years.

To ensure of processing security, AEROTHAI expected that the system should be equipped with an efficient firewall to protect an unrelated surveillance information.

As stated in the level of contingency and backup level-II, the TMCS comprised of two (2) surveillance data processing systems:

1. The Surveillance Data Processing (SDP) working on Main Surveillance Data Processing System (M-SDPS) is called “MSDP”; and
2. The SDP working on Fallback Surveillance Data Processing System (F-SDPS) is called “FSDP”.

The FSDP will be used as an alternative surveillance data processing function. It should be based on different algorithms to ensure that service continuity is maintained by the use of two independent surveillance chains.

Moreover, the Surveillance Direct Access messages should be used as another surveillance data source as stated in the level of contingency and backup level-III. The CWS will allow ATC to choose and display surveillance information coming from any surveillance data source at any time without interruption to their operation.

9.1.1 Mono-RADAR processing

The SDP will be designed to receive mono RADAR target reports messages and mono RADAR services messages from single RADAR sensor source. Then, the SDP produces track namely “local track” and distributes these data to other functions via internal network.

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9.1.2 Multi-RADAR processing

The SDP will be designed to receive mono RADAR target reports messages and mono RADAR services messages from multiple RADAR sensor source. Then, the SDP produces single track per aircraft namely “Multi-RADAR track” and distributes these data to other functions via internal network.

9.1.3 ADS-B processing

The SDP should be designed to uses separated processor to receive and process ADS-B messages from multiple ADS-B ground stations and produces single track per aircraft namely “ADS-B track” and distributes these data to other functions via internal network. The ADS-B validation techniques should be used for improve ADS-B track’s position and altitude.

9.1.4 MLAT/WAM processing

The SDP will be designed to receive Multilateration Target reports messages from multiple MLAT/WAM stations and produces single track per aircraft namely “MLAT/WAM track” and distributes these data to other functions via internal network.

9.1.5 Multi Sensor Fusion processing

The SDP will be designed to fuse multiple sensor data together, forming single track per aircraft namely “system track” that represents the consolidated estimate of physical position of the aircraft. The SDP distributes these data to other functions via internal network. Fusion process need to address the update rate of the various sources of data, the integrity of the positional data received etc.

9.1.6 Weather Information processing

The SDP will be designed to receive weather information from PSR and produces “Graphic RADAR weather picture” and distributes these data to CWS via internal network. The RADAR weather picture should contain up to six (6) levels of weather map intensity.

9.1.7 Surveillance data input

The SDP will be designed to handle surveillance data input, including ability for future expansion and processing multiple types of messages formats from various types of surveillance sensors as stated in Table 1 (NAS MOPS - Intersystem

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Interface Description), Table 5 (NAS MOPS - Surveillance Systems Information Exchange Description), Table 11 (APPS - Intersystem Interface Description) and Table 13 (APPS - Surveillance System Information Exchange Description).

The redundant data input lines will be used, all of them can be managed via the CMWS such as switching to alternative input line, inhibiting/exhibiting input line, displaying input line in used, data input line status, etc. When communication line problem and/or low quality data have been detected, the SDP should be automatically switched to alternate data input line and the SDP will be notified and logged at CMWS.

9.1.8 Pre-process

The SDP will be designed to analyze the incoming surveillance messages filtering out errors to protect the next process from incomplete messages. The SDP will also use plot overloads protection with the intention of filtering out excess plots such that when plot overloads are detected, the SDP will be notified and logged at CMWS.

9.1.9 Surveillance blanking areas

The surveillance blanking areas should be defined off-line for each surveillance sensor. The plots, tracked plots falling inside the blanking areas should not be used for tracking purpose.

9.1.10 Surveillance processing area

The surveillance processing area will be defined off-line and the SDP should not process targets outside the defined surveillance processing areas.

9.1.11 Barometric Altitude Correction

The barometric pressure or (QNH) will be used to correct the altitude of all aircraft below the transition level.

The QNH value should be defined by one of the following methods as a minimum:

- a) Automatic extracted from METAR messages received via the AMHS;
- b) Manually input by OPSUP.

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The SDP will be designed to correct the altitude of the system track using the flight level replies and the QNH value, according to the QNH area inside which the system track is located.

The QNH areas include the value of Transition Altitude (TA) and Transition Level (TL) should be system parameters off-line defined.

9.1.12 Altitude Tracking

The purpose of Altitude Tracking is to accurately follow the real flight profile when an aircraft changes its flight level. It will update related system track, at reception of valid Mode C information from an associated local track.

The Mode-S altitude and/or ADS-B altitude should also be used for altitude tracking.

9.1.13 Stereographic Projection

Aircraft positions from RADAR are received in RADAR coordinates of slant range, azimuth and altitude. The SDP will be designed to convert all RADAR-relative positions (range and azimuth) to system coordinates in a common system plane by applying a slant-range correction and a stereographic projection.

9.1.14 Specific codes

The SDP will be designed to receive the specific codes such as Special Position Indication code (SPI), emergency squawk codes (7500, 7600 and 7700) and immediately reported to CWS.

9.1.15 Test Targets Monitoring

The SDP will be designed to monitor the geographical position of the test targets. If a test target position falls out of tolerance, the SDP will be notified and logged at CMWS

The following test targets monitoring are concerned:

- a) Primary test target (test target report in the RADAR message);
- b) Secondary test target (test target report in the RADAR message);
- c) Permanent primary target; and
- d) Fixed beacon transponder.

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9.1.16 RADAR bias estimation

Due to different factors, such as noise in the radar detection and processing chain, position estimates provided for a given aircraft by several radar sensors may differ. In order to achieve maximum accuracy for system track position, the SDP will be designed to dynamically compute radar biases to establish the system track position.

If SSR site monitor(s) are available in surveillance coverage; the SDP will automatically calculating and recovering the range and azimuth bias errors.

9.1.17 Track overload protection

The SDP will be designed to protect track overload. Whenever the number of system tracks reaches the maximum number of system tracks of the SDP capacity, no new system track should be created and the overload status should be sent and logged at CMWS.

9.1.18 Track cancelation

The SDP will be designed to delete track that does not correspond to real aircraft or which are no longer detected by the surveillance detection coverage.

9.1.19 Automatic position report

The SDP will be designed to automatically report the aircraft position every predefine point when aircraft fly over these points.

9.1.20 Surveillance data distribution

The MSDP will be designed to simultaneously distribute the “local track”, “Multi-RADAR track”, “ADS-B track”, “MLAT/WAM track” and “system track” to other related functions via internal network with different multicast address and/or port number.

Specific data such as automatic position report information, the VLAN technique should be used in order to prevent disturbance to other unrelated functions.

The FSDP will be designed to simultaneously distribute the “local track”, “Multi-RADAR track”, “ADS-B track”, “MLAT/WAM track” and “system track” to other related functions via separated network with different multicast address and/or port number.

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9.1.21 System track distribution to external system

The SDP will be designed to distribute “system track” coupled with associated flight plan information in real time to external system, using latest ASTERIX Cat. 062, 063, and 065 formats over the IP network and geographical filter previously defined in adaptation. Firewall will be used for network secure.

The filter will have the following criteria, at minimum:

- a) The system track’s height/altitude is below or above a predefined threshold, or the height is between predefined range;
- b) The system track’s location is within predefined area of interest or polygon of interest;
- c) The system track’s SSR Mode Code is within predefined range or groups of predefined SSR Mode Codes;
- d) The system track’s callsign is within predefined range or groups of predefined callsigns;
- e) The system track’s aircraft identification is within predefined range or groups of predefined aircraft identifications;
- f) The system track’s aircraft registration address (24-bit address) is within predefined range or groups of predefined values; and
- g) The time during which the filter is valid;

User will be able to configure parameters for filters to be used. The configuration can be performed in real-time or off-line. Also, user can use multiple filters to sort desirable system tracks to be distributed. For example, user can specify system tracks with SSR Mode Code within predefined range and height above predefined threshold to be distributed.

9.1.22 Surveillance data analysis tools

Plots and tracked plots from several sensors should be separately recorded for purpose of data analysis. The software/hardware analysis tools for this purpose will be provided.

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9.1.23 Reconfiguration surveillance port

The surveillance data input/output ports should be configurable to allow for future expansion and/or reconfiguration. The hardware, accessory, related software, integration procedure, reference document, facility and essential software tools will be provided.

9.2 Flight Data Processing

The Flight Data Processing function (FDP) receives and processes ATS messages in order to provide Air Traffic Controllers with accurate and up-to-date flight information, in a timely fashion, for use in flight planning, coordination and control.

9.2.1 Source of Flight Plans

The FDP will be able to handle Flight Plan (FPL) from the following sources:

- Local Operator entry
- Via AMHS
- Automatic or manual activation of Repetitive Flight Plans (RPLs)

9.2.2 Flight Plan and Flight Related Message Validation

The FDP will validate the syntax and semantics of all the fields of filed flight plans, current flight plans, and flight plan related messages to ensure that all the data is syntactically and semantically correct in accordance with the relevant ICAO and Euro control standards. When the errors or inconsistent data are detected, operators will be notified. Then, the operators can correct flight plans and/or messages without the need to re-enter the entire set of data using provided tools.

For invalid messages received from external sources, a rejection will be sent to the source and a local operator notified of the error. Operator notifications will be explicit and indicate the nature of the detected error. For example, “Aircraft type incompatible with Wake Turbulence Category” or “Flight Plan duplicates existing Aircraft Identification (ACID)”. It should be noted that some data inconsistencies will be treated as warnings only whereas others will be treated as errors. The operator can choose to submit flight plans or flight related input with

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warnings, effectively overriding the check. As well as checking the flight plan data, the FDP also performs a duplicate flight plan check based on aircraft callsign, departure aerodrome, destination aerodrome, and estimated time of departure. If the flight plan does not comply with the duplicate flight plan validation check, the operator will be notified. For flight plan related messages, the flight plan and aircraft state are checked to ensure consistency between the received message and the flight plan and aircraft states. All fields in the flight plan or flight plan related messages are processed fully to ensure all relevant information is extracted and committed to the system flight plan. The Field 18 Other Information field is also processed to identify key data such as Medevac, Head of State, RVSM etc.

9.2.3 Route validation

The FDP will validate route element in Bangkok FIR against the route infrastructure defined in the FDP database. The FDP will check the continuity of route and part of the trajectory calculation. The FDP will support the re-enter flights as long as the route remains within the route infrastructure database. The FDP will also checks aircraft equipage for compatibility with the route to be flown.

9.2.4 Trajectory Prediction

The Trajectory Prediction (TP) is a fundamental requirement of the FDP in its role of monitoring and controlling flights. TP calculations for each individual flight form the basis of timely flight plan data presentation to controllers. This processing should be made at the time of the first FPL creation and after subsequent modifications due to an automatic event(s) e.g. position reports from SDP or manual input of certain data (route and/or performance modification).

The TP calculates all points at which the flight will enter into/exit from sectors in order to determine a sector pattern. These points referred to as a 4D trajectory are described in terms of latitude, longitude, altitude, time and sometimes even type (i.e. start of turn, end of turn, bottom of climb, top of climb, top of descent, bottom of descent).

The 4D trajectory projected from the aircraft's current position on the planned route creates a sector pattern. This data can be used by functions such as monitoring aids and MTCD to generate tubes (representing the flight path) with a

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series of windows at each point along the trajectory that confirms if an aircraft is following the agreed trajectory or will conflict with another aircraft.

At the very least, the following parameters should be used when calculating the trajectories:

- Aircraft categories
- Aircraft category characteristics (EUROCONTROL BAse of Aircraft DAta : BADA)
- Sectors
- Sub sectors

The TP should also be capable of refining its prediction when new constraints from external systems or controller input become known. Such constraints could come from weather data, Demand and Capacity Balancing (DCB) function, and Traffic Synchronization (TS) function or manual input by a controller.

Weather data such as wind and temperature have an effect on the flight profile since wind data affects ground speed and temperature affects rates of climb. The system should be capable of processing incoming weather data and creating met areas that consider wind speeds, wind direction and temperature in order to process trajectories in a realistic and dynamic manner. Other related function should make use of the same Trajectory Predictions as the FDP for its initial calculations.

9.2.5 Conceptual Flight State Model

In order to clarify the specification of the processing of a System Flight Plan (SFPL) (e.g. input validation, data presentation, function activation, etc.) throughout the different stages of its life, a conceptual state model is described. It should be noted that the actual existence of these states is not itself a requirement upon the system. The model identifies the states Initial, Notified, Active and Terminated, and is defined as follows:

A SFPL is considered in the Initial state from the time that the filed flight plan is received until an operational indication is made that the flight is confirmed. The Notified state describes an SFPL for which an operational confirmation has been entered (e.g. start-up/taxi, notification prior to coordination, etc.), but which is not active.

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An active SFPL may revert to the Notified state once the aircraft has left the system area of interest; if it is due to re-enter the area of interest (AoI) (i.e. is re-entrant). Such flights may include aircraft departing the AoI to perform some kind of maneuvers abroad (e.g. photographic, practice touch-and-goes, etc) prior to returning, and mixed rule IFR-VFR-IFR flights.

9.2.6 Strip Less

In order to enhance the flexibility and the versatility of air traffic control operations, reduce workload and to enable information sharing as well as Collaboration Decision Making (CDM), the FDP must be supported by a strip-less operations.

The strip-less will replace paper strips and enable the ATC to reduce manual coordination. This is possible since clearances etc, traditionally written on paper strips, can now be directly entered via the track label or flight lists.

Once the ATC enters a clearance e.g. a cleared flight level, the information will be known to the system and accessible by all operators. From a system level point of view these inputs may be used to update functions in FDP. Some functionality that improves safety or enhances automation is totally dependent on receiving this data.

At an operational level the information is automatically distributed to the relevant ATC which reduces and in some cases eliminates voice coordination between ATC, thereby reduce overall workload.

9.2.7 System Track Association/Disassociation

The FDP will support automatic and manual associate/disassociation for discrete and non-discrete codes, callsign or aircraft address. When association is successful, the track display for the flight will change.

Automatic association uses the SSR code assigned to the flight and attempts to find a corresponding track transmitting that code. In addition, for Mode-S or ADS-B tracks, aircraft callsign can also be used.

When a surveillance track is received from the SDP, automatic association processing is initiated for the track. If the track is already associated with a flight plan then the SSR code is compared with the assigned code for the flight. If the codes do not match, a warning may be provided to the ATC.

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9.2.8 SSR Code Management

Aircraft Identification and SSR Code Management is a standard feature where SSR code allocation is performed according to regional agreement. The FDP will provide a discrete SSR codes to flights in a way to avoid the exhaustion of available codes and reduce the number of mid-flight code changes. The FDP will be capable of handling and allocating SSR codes in accordance with these agreements, having the availability of SSR codes being divided into groups.

9.2.9 Flight Clearance

The FDP will allow entry of the full range of ATC clearances, including clearance limit where expected further clearance time required, instructions and restrictions. That could be reflected to the trajectory calculation and related function. The FDP will support difference type ATC clearances such as departure clearance, tactical changes, strategic planning, trial probes, and CPDLC integration.

The following clearances will be supported:

- Cleared level
- Ordered Speed (also cancel Speed instruction)
- Ordered Direction (also cancel Direction instruction)
- Ordered Heading for holding (also cancel heading holding instruction)
- Leaving holding

In addition the system should enable the ATC to be able to set coordination levels, exit/entry flight levels.

9.2.10 Sectorization

The FDP will be able to define and maintain the division of airspace into units according to ATC jurisdiction. All details of airspace structures and rules will be defined in the dataset relevant to sectorization plan which compose of the following:

- Subset of the positions in the ATSU;
- The main jurisdictional component which defining an area of responsibility and comprising one or more sectors;

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- Unit of jurisdiction
- Specialized airspaces such as terminal and tower for which additional rules are defined

9.2.11 Flight Data Posting

The posting rules are adapted to operational needs of each position according to TP.

9.2.12 Flexible Use of Airspace

The FDP will be able to configure Flexible Use of Airspace (FUA) via off-line or automatically updated by NOTAM, and will allow the ATC create dynamically on the CWS by defined the following data as a minimum;

- Activation status;
- Code group;
- Kind (Alert, Danger, fuel dumping , etc);
- Lead time;
- Description;
- Criticality;
- Volume definition.

9.2.13 Flight Data Distribution

The flight data distribution allows the FDP to distribute flight information to other parts of the system and external systems. The FDP will send information of all flights which having a trajectory intersection with the bounding area of interest around the sector airspace. For external system the FDP will send flights information using standard protocol and format such as OLDI, AIDC, ICAO 4444, EUROCONTROL ATS Data Exchange Presentation (ADEXP), etc. where applicable.

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9.2.14 Inter Sector Coordination

The basic principle of sector coordination is that the EC are able to handover and assume flights to/from an adjacent sector or FIR. Generally during an inter sector handover procedure the following actions should be supported:

- Initiate Handover
- Interrupt Handover
- Assume flight

An important function for inter sector coordination is the ability of the system to monitor when a controlled flight is due to pass from a sector controlled by one EC into another sector controlled by another EC. If the EC working in the first sector is also controlling the flight (assume state) and does not initiate coordination, the system must give a warning. The warning should be given to both EC involved in the inter sector coordination. It is important that the warning is given in different colours so that the EC can quickly identify if it is related to a Handover or Assume action.

The warning is triggered from a defined time (should be a configurable system parameter) before or after the flight's crossing of the sector boundary as determined from the trajectory. Once the coordination is initiated or flight is assumed the warning should be removed. The system should allow for the configuration of either automatic or manual transfers. A configuration supporting automatic transfer results in reduced ATC workload since the system performs automatic assume control and automatic handover for activated flights.

Similar principles apply when the flight is due to pass from a controlled sector into a sector classified as an adjacent FIR. However the system should allow for different parameter settings for triggering the following warnings:

- Warning for coordination with next sector
- Warning for coordination with next FIR
- Warning for exit from controlled airspace

9.2.15 AIDC Coordination

Flight progress control allows the ATC to issue departure and en-route clearances, perform coordination/transfer dialogue between ACC and to modify

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any flight data, up to and including complete rerouting of the flight. The ATS Inter facility Data Communication (AIDC) enables safe handover of flights with assistance from the strip-less Human Machine Interface (HMI) provided to the ATC and is available during coordination and “transfer of communication” dialogue between adjacent ACC’s. In order to provide a safe, accurate transfer, the flight progress control must be able to perform automatic checks that assure flight data consistency between received messages and related flights.

The FDP will support ICAO Asia Pacific Regional Interface Control Document for AIDC version 3.0.

9.2.16 Flexible EC and PC Management & Multi Sector Planning

Area(s) of responsibility (AoR) have a high level of impact on several FDP progress control. The flexible EC and PC Management allows an ATC to assume/split the responsibility of AoR and tasks being handled by another EC and PC depend on traffic situation. The system will support Flexible Role Management.

Another form of flexibility is in the use of Multi sector Planner Controller (MSP). MSP is responsible for the medium-term planning of the trajectories of aircraft that enter the region of airspace, called a Multi-Sector Area (MSA), with which he is associated. As the name suggests, a Multi-Sector Area is comprised of number of “traditional” sectors. ECs are still responsible for providing ATC services within each sector; however the purpose of the MSP is to ensure the ECs are never subjected to a workload that could jeopardise safety.

The system should be able to allocate an MSA to a specific MSP role. Additionally the system should be capable of enabling coordination between MSP and the EC positions within the MSA. On a strategic level the system should allow the MSP to coordinate with adjacent sectors associated with these EC.

9.2.17 Database Organization and Access

The FDP will organize data into several databases for easy maintenance and retrieval of information. There are many technical and operational databases. The FDP will provide an access to these databases using on-line commercially available query tools. Tools are provided to perform Data Administration.

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Functions include the capability to create, delete, archive, restore and compare databases.

9.3 Safety Nets

Safety Nets are functions that alert ATC in monitoring the air situation continuously with visual and aural warnings, by detecting potential conflicts and infringements, based on the surveillance data, and providing timely information to enable the affected ATC to assess and, if necessary, resolve the situation by taking deliberate, corrective action.

In addition, the Safety Nets should be designed to use information from Surveillance Data Processing, Safety Nets' data set and possibly Flight Data Processing in order to generate alerts.

Furthermore aircraft information through Mode-S, ADS-B and MLAT/WAM should be used to improve the Safety Nets function.

The Safety Nets will provide alert information to CWS. The authorized user such as OPSUP will be able to enable or disable each Safety Nets feature.

The Safety Nets will be established to ensure that Safety Nets are used in a safe and effective manner. The pertinent data will be collected for purpose of operational data extraction and analyzed in order to monitor and optimize the performance of Safety nets.

The Safety Nets will have, at minimum, the following features:

- a) Short Term Conflict Alert (STCA);
- b) Minimum Safe Altitude Warning (MSAW);
- c) Area Proximity Warning (APW); and
- d) Approach Path Monitoring (APM).

9.3.1 Short Term Conflict Alert (STCA)

The Short Term Conflict Alert (STCA) will assist and warn the ATC in preventing collision between aircraft in surveillance coverage area. It will alert on the potential infringement (Predict Conflict Alert) and actual infringement (Conflict Alert) by using the separation standards (area of conflict) between two (2) or more aircraft at any time.

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Two (2) stages of STCA warning will be provided.

- a) Predicted Conflict Alert (PCA) will alert when two (2) or more aircraft are predicted to enter an area of conflict within an adaptable time which will take into account of the velocities of concerned aircraft.
- b) Conflict Alert (CA) will alert when two (2) or more aircraft are within an area of conflict.

In addition, STCA will take into account a RVSM aircraft (RVSM: Reduced Vertical Separation Minimum) and whether the aircraft is/are in the RVSM airspace.

The STCA will be capable of using different parameters to generate alerts in different STCA volumes of airspace at different moments in time. A large number of volumes of airspace may need to be defined so that parameters can be tuned according to the use of individual volumes of airspace, including which flights are eligible for the generation of alerts.

The authorized user will be able to inhibit STCA alerts for predefined volumes of airspace or individual flights to suppress unnecessary alerts.

9.3.2 Minimum Safe Altitude Warning (MSAW)

The Minimum Safe Altitude Warning (MSAW) will assist and warn the ATC about increased risk of controlled flight into terrain and/or obstacles by generating, in a timely manner, an alert of aircraft proximity to terrain and/or obstacles.

It may be necessary to inhibit alerts for predefined volumes of airspace (e.g. exercise areas) or for specific flights (e.g. Calibration Service Aircraft on a defined flight pattern) to suppress unnecessary alerts.

In addition, MSAW will be capable of using different parameters for generation of alerts. Different parameters may be applied in the case of system degradation (e.g. unavailability of one or more RADAR/ADS-B stations).

Alerts will be generated at least at CWS of the controlling ATC.

9.3.3 Area Proximity Warning

The Area Proximity Warning (APW) is a safety net which uses surveillance data and flight path prediction to assist and warn the ATC when an aircraft is, or is

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predicted to be, flying into a volume of notified airspace (APW volume of airspace), such as controlled airspace, danger areas, prohibited areas, restricted areas and temporary restricted areas.

The APW will issue an alert when an aircraft is about to infringe a defined volume within a pre-defined time interval and when an aircraft has entered a APW volume of airspace based on the surveillance data and/or flight plan data.

The APW volume of airspace will be defined in adaptation data, and their activation times should be modified on-line. Moreover the APW volume of airspace will be created dynamically on-line.

The APW will outline the APW volume of airspace on the CWSs in an adapted format to alert the ATC at an adaptable time interval before APW volume of airspace becomes active (at pre-warning stage). The APW volume of airspace will be outlined in another adapted format when the APW volume of airspace becomes active (active stage).

It may be necessary to inhibit alerts for predefined volumes of airspace (e.g. exercise areas) or for specific flights (e.g. Military Aircraft(s)) to suppress unnecessary alerts.

In addition, APW will be capable of using different parameters for generation of alerts. Different parameters may be applied in the case of system degradation (e.g. unavailability of one or more RADAR/ADS-B stations).

9.3.4 Approach Path Monitoring

The Approach Path Monitoring (APM) is a safety net which uses surveillance data prediction to assist and warn the ATC when an aircraft is, or is predicted to be, flying into an Approach Path Monitoring area (APM volume of airspace) with a heading within an adapted range.

APM should detect only deviations below the glide slope, whereas in some cases APM also detects lateral deviations or deviations above the glide slope.

APM should perform for both precision and non-precision instrument approaches. However, for circling approaches, APM should not be expected to operate in circling area/circling prescribed track.

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The APM will be capable of using different parameters for generation of alerts. Different parameters may be applied in the case of system degradation (e.g. unavailability of one or more radar stations).

9.4 Monitoring Aids

The Monitoring Aids function (MONA) is ATC assisting tool in the routine monitoring of the traffic situation, warning the ATC with visual and aural when aircraft deviate from their planned route or clearances, reminding the ATC of actions that need to be performed, and keeping the trajectories updated with the progress of the flights.

The MONA should be designed to use information from Surveillance data Processing, MONA's data set, Flight Data Processing, and possibly trajectory prediction in order to generate alerts.

In addition, aircraft information through Mode-S, ADS-B and MLAT/WAM should be used to improve the MONA.

The MONA will provide alert information to CWS. The authorized user such as OPSUP will be able to enable or disable each MONA feature.

The MONA will have, at minimum, the following features:

- a) Conformance monitoring; and
- b) Automatic reminder

9.4.1 Conformance monitoring

The conformance monitoring feature compares the system track with the corresponding flight clearances in order to warn the ATC of any deviation of a flight from its clearance and, where possible, to establish the progress of the flight and to refine the prediction of the remaining trajectory to be flown.

The conformance monitoring function will be designed to performed varies according to the type of clearance issued. In principle, warnings of deviation are generated in cases where the controller might be required to act to re-clear an aircraft that is assumed to be deviating from its clearance or to re-coordinate an aircraft whose boundary estimate changes significantly.

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The MONA will use a planned trajectory and tactical trajectory to recalculate the trajectories that are active for a flight according to the actual behavior of the aircraft, as follows:

- a) Lateral Conformance Monitoring;
- b) Longitudinal Conformance Monitoring;
- c) Vertical Conformance Monitoring; and
- d) Progress Monitoring.

9.4.1.1 Lateral Conformance Monitoring

The purpose of lateral conformance monitoring feature is to detect lateral position of aircraft which deviates from their planned or assigned route.

ATC will be warned when an aircraft is deviating and/or estimated to deviate from its planned route or assigned route.

9.4.1.2 Longitudinal Conformance Monitoring

The purpose of Longitudinal Conformance Monitoring feature is to refine the time estimates in the planned trajectory and tactical trajectory.

ATC will be warned when, due to large changes in the time estimates on a coordination point, re-coordination of the flight is necessary. ATC will also be warned when the aircraft speed deviates from the assigned speed.

9.4.1.3 Vertical Conformance Monitoring

In the vertical plane, the Vertical Conformance Monitoring feature monitors the vertical movement of the aircraft in order to warn the ATC of deviation from a cleared level, assigned level or vertical rate, and to refine the calculation of the planned and tactical trajectories.

9.4.1.4 Progress Monitoring

The purpose of Progress Monitoring feature is to detect significant flight events such as take-off, landing, and control area (sector) entry/exit.

9.4.2 Automatic Reminders

Automatic reminders feature provide reminders to the ATC for routine events that are performed at a time or distance relative to a point in the planned trajectory as follows, but not limited to:

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- a) Transfer an aircraft to the next sector;
- b) Coordinate a flight where automatic means are not available; and
- c) Issue a maneuver clearance to the aircraft e.g. change of flight level or heading.

9.5 Medium-Term Conflict Detections

Medium Term Conflict Detection function (MTCD) will be designed to assist the ATC of interactions that occur in the medium-term (e.g. up to 30 minutes) that might require aircraft to be re-planned or re-cleared or may affect the choice of a desired (vertical or lateral) clearance. Based on the predicted flight trajectories, the MTCD detects potential conflicts and airspace penetrations. Then it provides timely information to enable the affected ATC to assess and, if necessary, resolve the situation by taking deliberate, corrective action. Additionally, the MTCD provides a facility for handling tentative flight trajectories. This facility enables ATC to assess the potential effects of an intended action (a reroute, cleared level change or ordered speed input) which will result in a change to the existing trajectory for a flight.

An encounter denotes the predicted approach of an aircraft within a specified distance of another aircraft, or a designated volume of airspace. There are two (2) types of encounter classified respectively as “aircraft to aircraft” and “aircraft to airspace” encounters.

9.5.1 Aircraft to aircraft encounters

Aircraft to aircraft encounters are further classified as either based on the Tactical Trajectory or on the Planned Trajectory.

- a) Tactical based encounters

A tactical-based aircraft-to-aircraft encounter represents a conflict between aircraft where the position of one or both aircraft is determined from the tactical trajectory. It is further classified according to whether the aircraft are flying according to conflicting clearances or whether the conflict is a result of an aircraft deviating from its clearance.

- b) Plan based encounters

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A plan-based aircraft-to-aircraft encounter represents an encounter between two aircraft such that the possible actions available on each aircraft are limited by the presence of the other, e.g. one aircraft flying 2000 feet above another aircraft.

A problem is further classified as either an “entry problem”, an “exit problem”, or an “in-sector problem”. Normally, in a two-controller sector configuration, the PC would be responsible for solving entry and exit problems; depending on the tactical workload and the nature of the problem, the PC might also solve or prepare a resolution for an in-sector problem.

Thus, an interaction will normally comprise a problem together with a number of context aircraft that constrain the resolution of the problem. Occasionally, a number of problems may be grouped under a single interaction where it is likely that they may all be solved by a single action.

Alternatively, an interaction might contain no problems, only context encounters, indicating aircraft in proximity to one-another and therefore airspace that is blocked to each other.

9.5.2 Aircraft to airspace encounters

Upon creation and each update of a flight’s trajectory, it is validated against airspace restrictions including conditional routes and temporary segregated airspace. In addition, the change of status of a temporary airspace restriction or the creation of a new airspace restriction requires the revalidation of all flights.

Aircraft to airspace encounters are further classified as airspace intrusion and hold intrusion.

a) Airspace Intrusion

Within the concept of the Flexible Use of Airspace (FUA), Temporary Reserved Areas (TRAs) and Temporary Segregated Areas (TSAs) are established in response to the need for civil, military, or activities of a temporary nature which, due to the nature of their activities, need segregation to protect both them and non-participating traffic. TRAs and TSAs are allocated by the Airspace Management Cell pre-tactically

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(normally the day before operations) in response to daily requests for specific periods, and are activated tactically in accordance with the actual requirement.

Upon creation and each update of a flight's trajectory, it is validated against scheduled and actual airspace restrictions. However, an unscheduled change of status of a temporary airspace restriction or the creation of a new airspace restriction requires the revalidation of all flights.

The aircraft to airspace encounters feature will re-validates flight trajectories upon activation and de-activation of airspace restrictions.

b) Hold Intrusion

Holding is a procedure used to delay an aircraft whilst confining it to a designated portion of airspace. A holding procedure is defined in relation to a fix (radio navigation aid, significant point or designated location), whereby the aircraft normally flies a racetrack pattern comprising two 180 degree turns lasting one minute, interspersed with straight legs at a given heading, each also of one minute duration.

The most common use of holding is in the form of a holding stack for regulating aircraft waiting to land at a congested airport or where the landings are interrupted, e.g. due to a blocked runway or bad weather. Aircraft normally join the stack at the top and are progressively descended when levels below become available. The aircraft at the bottom of the stack is normally the first to leave to commence its approach to land.

As aircraft normally have a higher ground speed at higher levels, the airspace required to protect the holding stack gets progressively larger at increasing levels.

The aircraft to airspace encounters feature will detects flights whose planned trajectory traverse active levels of a holding stack.

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9.6 Airspace Organization and Management

Airspace Organization and Management function (AOM) will establish airspace structures in order to accommodate the different types of air activity, volume of traffic and differing levels of service. Airspace management is the process by which airspace options are selected and applied to meet the needs of the ATM community.

Key conceptual changes include:

- a) All airspace will be the concern of ATM and will be a usable resource;
- b) Airspace management will be dynamic and flexible;
- c) Any restriction on the use of any particular volume of airspace will be considered transitory; and
- d) All airspace will be managed flexibly. Airspace boundaries will be adjusted to particular traffic flows and should not be constrained by national or facility boundaries.

Coordinated planning among adjacent areas will be conducted with the objective of achieving a single airspace continuum. The airspace within that continuum will be free of operational discontinuities and inconsistencies. Airspace will be organized to accommodate the needs of the different types of users on a timely basis. Transition between areas will be transparent to users at all times.

The AOM will provide the first layer of conflict management. Effective airspace organization and management will enhance the ability of the ANSP and airspace users to accomplish conflict management and will also increase safety, capacity and efficiency.

9.7 Flexible Use of Airspace (FUA) Coordination

Flexible airspace configuration will be designed to support changes in TMCS services according to traffic flows, airspace restrictions and runway configuration at major regional airports. These dynamic changes are monitored and controlled by the flight progress control features of the FDP. There will be support for temporary and/or existing airspace structures required for the efficient use of the FUA concept. The system should support on-line redefinition and presentation of sectors including opening and closing. The various airspace structures that should be supported are, at minimum:

- a) Conditional Routes (CDR's)

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- b) Temporary Reserved Areas (TRA's)
- c) Temporary Segregated areas (TSA's)

9.8 Demand and Capacity Balancing

The Demand and Capacity Balancing function (DCB) will be to minimize the effects of ATM system constraints. It will be capable of evaluating system-wide traffic flows and capacities in order to implement necessary actions in a timely manner. A collaborative process will allow for the efficient management of the air traffic flow through the use of information on system-wide air traffic flows, weather and assets.

The DCB will allow airspace users to optimize their participation in the ATM system while mitigating conflicting needs for airspace and aerodrome capacity. Collaborative usage of decision-support tools will ensure the most efficient use of airspace resources, provide the greatest possible access to airspace resources, provide equitable access for all airspace users, accommodate user preferences and ensure that demand on an airspace resource will not exceed its capacity.

The DCB will be integrated within the ATM system. It will be undertaken at the strategic, pre-tactical and tactical stages.

9.9 Air Traffic Flow Management

The main purpose of the Air Traffic Flow Management (ATFM) is to compare traffic demand with available sector capacity. In cases where demand exceeds the sector capacity, the system will be able to make the information available to the flow manager. In conjunction with the Supervisor they would decide whether or not to implement a 'regulation', delaying flights through the manual coordination with neighboring units and effectively moving the excess traffic out of the overload period. Re-routing of a flight will also be an option to resolve the situation.

ATFM is not only responsible for 'Tactical' operations (day of flight) but also for a significant period of the 'Pre-tactical' operations (from 1-6 days prior to airborne). ATFM function supports the flow manager by calculating traffic demand in every sector within the Bangkok FIR area, using the FPL and RPL information gathered from the flight plan data acquisition phase. The demand will be displayed for the day of flight and up to 6 days prior to airborne.

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9.10 Traffic Synchronization

Traffic synchronization function (TS) refers to the tactical establishment and maintenance of a safe, orderly and efficient flow of air traffic. TS, conflict management and DCB are interrelated and will become fully integrated, leading to a continuous and organized flow of traffic.

The TS encompasses both the ground and airborne part of ATM and will constitute a flexible mechanism for capacity management by allowing reductions in traffic density and adjustments to capacity in response to variations in demand.

9.11 Arrival Manager

The Arrival Manager (AMAN) function will support the tactical flow into airports and to enable efficient sequencing and scheduling a support functions is required in order to reduce ATC workload. The AMAN takes multiple constraints into account along with the Airports' preferences.

The AMAN will be able to allocate arrival routes and set constraints such as controlled time of arrival on merging points with the objective of building an optimum sequence. The controlled time of arrival technique fits well with time based spacing which would follow on after passing the controlled time of arrival point.

The use of improved trajectory data allows the AMAN process start earlier to deliver traffic efficiently into the structured arrival route system at the optimal place and time, which will enable all of the above to happen with minimum tactical intervention. Therefore, the preparation of the arriving traffic sequence is expected to be completed by around 20 minutes prior to touchdown, and should start only as early as necessary to achieve the stated

9.12 Departure Manager

The Departure Manager (DMAN) is to help aerodrome control to build an optimized Departure sequence issue in accordance with departure demand and departure capacity.

DMAN is a planning function to improve departure flows at one or more airports by calculating the Estimate Take Off Time (ETOT) and Target Start Up Approval Time (TSAT) for each flight, taking multiple constraints and preferences into account.

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The DMAN should adjust the plan in the background, taking account of actual events. Those adjustments are displayed to relevant tower workstation to support the tactical handling of departures and may result in exceptional TSAT changes.

DMAN will function also on runways used for arrivals and departures in mixed mode operations. DMAN will plan initially around arrivals. If this results in an unbalanced situation between arrivals and departures, it is envisaged that the arrival manager (AMAN) will start increasing the spacing of the arrivals to allow for departures, and the DMAN would use the gaps as good as possible.

9.13 Controller Pilot Data Link Communication

The purpose of the Controller Pilot Data Link Communication (CPDLC) function is to provide air-ground data communication for the ATC service. At the highest level, the concept is simple, with the emphasis on the continued involvement of the human at either end and the flexibility of use. This includes a set of clearance/information/request message elements which correspond to voice phraseology employed by ATC procedures.

The ATC is provided with the capability to issue level assignments, crossing constraints, lateral deviations, route changes and clearances, speed assignments, radio frequency assignments, and various requests for information. The pilot is provided with the capability to respond to messages, to request clearances and information, to report information, and to declare/rescind an emergency. The pilot is, in addition, provided with the capability to request conditional clearances (downstream) and information from a downstream Air Traffic Services Unit.

A “free text” capability will be provided to exchange information not conforming to defined formats. An auxiliary capability will be provided to allow a ground system to use data link to forward a CPDLC message to another ground system.

The sequence of messages between the ATC at an Air Traffic Services Unit and a pilot relating to a particular transaction (for example request and receipt of a clearance) is termed a ‘dialogue’. There can be several sequences of messages in the dialogue, each of which is closed by means of appropriate messages, usually of acknowledgement or acceptance. Closure of the dialogue does not necessarily terminate the link, since there can be several dialogues between ATC and pilot while an aircraft transits the Air Traffic Services Unit airspace.

The CPDLC function comprise of three (3) primary features:

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- a) The exchange of ATC/pilot messages with the current data authority;
- b) The transfer of data authority involving current and next data authority;
and
- c) Downstream clearance delivery with a downstream data authority.

9.14 Air Situation Recording and Replay

The Recording and Replay function (REC/REP) will have, at minimum, the following features:

- a) Recording (REC);
- b) Replay (REP); and
- c) Archive media.

9.14.1 Recording

The Recording feature (REC) will be designed to provide automatic on-line recording of all data such as surveillance data, flight plan data, weather information, safety nets, monitoring aids, AMAN, DMAN, system events, ATC interactions, operator logons, interface messages (both received and sent), maps, all system alerts and other data. This data will be rapidly recalled for replay and/or offline analysis purposes without interfering with ongoing recording and all recorded data is time stamped with UTC time to the granularity required such that events are re-generated correctly during a replay.

Each record server will use fault tolerant RAID disks (level 1 or 5) to prevent data loss. If one of record disk fails, a disk failure status will be alert on CMWS and recording will continue without impacts. If one of record server fails, there will be no impact on the other record server which simultaneously records the same data.

The RAID disks size will have the capacity to store data, at minimum, for the proposed data retention period of sixty (60) days. The data retention period will be configurable as desired. At the end of the data retention period, the oldest data will be automatically overwritten by the new data being received. The overwritten data will still be available on archive media until such time that the archive media is reused.

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Every twelve (12) hours (or configured as desired), the recorded data on record server master channel will be automatically archived for safe keeping beyond the retention period. If the record server needs to archive data and no archive media is mounted in the unit, the archive manager will alert on CMWS.

9.14.2 Replay

The Replay feature (REP) will be designed to allow recorded information to be replayed on the CWS. Multiple positions can be replayed simultaneously to analyze incidents or to provide instruction. The replay function will be retrieval the recorded data based on specified condition including position name, starting date and time, media type and audio track number. The replay feature will comprised of two replay modes as follows, but not limited to:

- a) Passive mode: where there is no interaction allowed with the presentation of data; and
- b) Interactive mode: In this mode the user can interaction such as range scale, pan, zoom in-out, rotate track label and range bearing lines.

The REP will allow flexible control to replay the recorded data from record disk and archive media such as start/stop, pause/resume, and speed of replay.

The REP will be synchronized with DVR at normal speed and deviation of data and voice will be less than one second. REP replay speed can also be slowed down, so that the situation can be more closely analyzed or speeded up to bypass sections of no interest. It can also pause/resume at any time. While replay is running, user can make a screen captures as standard graphic files such as jpeg format. It will be possible to export short period replay (both video and audio) in suitable format for a replay on widely available media player software such as H.264/MPEG-4, AVI format.

9.14.3 Archive Media

Two types of archive media will be used to record and replay data as follows:

- a) The Digital Data Storage Tape (DDS) will be used as archive media for record and replay data; and
- b) The DVD disc and/or USB flash drive will be used as archive media for export short period replay purpose.

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9.15 Data Analysis

The Data Analysis function (DAA) will provide the facility to collect the recorded data and make them available for statistic, analysis. DA will be able to generate reports in various formats such as Microsoft excel, XML, PDF, text etc. Reports generation will be performed in an automatic manner at a predefined time each day or in a manual manner by user action. In addition, report data should be suitable for export to an external system (CIFDPS).

The statistical reports will include the statistics on a daily, weekly, monthly and yearly period such as total number of aircraft movement in an airspace sector, total number of flights handled by the TMCS, total number of messages exchanged in the TMCS, total number of arrival flight to an airport in controlled airspace, etc.

The analytical data will be used for an in depth inspection such as plotting trajectories from RADAR track, ADS-B track, MLAT/WAM track, system track, for Safety Nets analysis, etc.

9.16 Aeronautical Information Management

The Aeronautical Information Management function (AIM) will be designed to provide appropriate aeronautical information to ATC.

This information comprises of graphical and text-based information, such as eAIP, Aeronautical charts, restricted area information, danger area information, local restriction information, all airspace definitions, NOTAM, Digital NOTAM, MET, etc.

The specific software tools will be provided for preparing the aeronautical information. In addition, some aeronautical information such as NOTAM, MET, Digital NOTAM, etc. will be received from AFTN/ATN/Other System.

Furthermore, AIM will provide facility to ATC to retrieve and display related aeronautical information in related windows on the CWS.

9.17 Time Management

The purpose of time management function (TM) is to synchronize time. TM will use functionalities of NTP in order to synchronize time with GPS Time Server in Coordinated Universal Time (UTC) format over internal network.

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For the remote control towers, they should synchronize time over wide area network (WAN).

The TM will use hierarchical client-server model.

9.18 CWS HMI

CWS is the heart of the system due to its interaction with the operator. Any TMCS' operator such as Tower, Terminal/Approach or Area Control center will be able to access Surveillance, Flight, and Maintenance and Supervisory data at any working position within their suitable working area. Individual configurations will be based on the operator's role, login permissions, preferences and the sectorization plan. Operator roles and permissions are off-line definable and role-based. Once a role has been assigned to an individual, that person can access the functionality mapped quickly and effectively. The Characteristics of all CWS HMI will meet the requirements of FAA Human Factor Design Standard (HFDS) 5.1.6 "Luminance and Contrast" and FAA 2100G Clause 3.3.6.4 "Visual Displays", or comparable standards specified by ICAO or EUROCONTROL.

9.18.1 HMI Principles

The presentation management described herein is based on the use of windows, permitting the grouping and selective presentation of the diverse data managed by the system. Standard window operations are specified (open, close, move, resize). However, due to the nature of the ATC, additional safeguards are valuable to ensure that critical data is not erased or obstructed.

A key factor governing the ease of learning how to use the system, and the safety of its use, is the consistency of its presentation and input methodology across all windows. As such, a style guide is necessary, detailing generic features such as color usage, window layout and decoration, pointer button operation, orientation of field label relative to a field, etc., that is used in the design of the HMI.

Describing the use of a "Conceptual Object", containing the "real world" representation of an entity, should specify the consistency of the presentation of a common data object in multiple windows. From a conceptual object, "Presentation Objects" may be created to display the entity in various windows. Any change to the conceptual object is reflected in all of its presentation objects. Similarly, a conceptual object may be updated by operating on any one of its presentation objects.

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Additionally, a consistent presentation method for depicting object statuses (alerts, warnings, co-ordination, etc.) between different presentation objects and windows provides an intuitive appreciation of the condition.

9.18.2 Traffic Situation Presentation

The Traffic Situation Presentation is the primary tool providing traffic data to support the EC, and is a secondary tool for supporting other users (PC, OPSUP, etc.) to obtain situation awareness. The Traffic Situation Presentation is composed of selectable maps, upon which the traffic and weather, if available, are projected. Traffic data will consist of a representation of the track/plot complemented by the label. It contains all the information available in the correlated system track. This information can be made available to the TMCS' operators.

In order to meet the needs of both BACC and APPs operation, the traffic display can be selected from either the system track picture or from a picture based on a single source. This latter, exploiting the higher update rate and increased accuracy of the target, allows a reduction in the radar separation within (parts of) the APPs. A number of graphical tools (graphical flight leg projection, range and bearing) and the presentation of the ATC tools (MONA, Safety Nets, etc) are also incorporated in the Traffic Situation Presentation. Map configurations are defined as part of the offline environment. Each configuration comprises a number of map elements and defines their presentation attributes. A user is able to choose a particular map configuration and then select for display individual elements within the configuration. Maps may also be defined online and distributed to other users.

The display also contains tabular depictions of flight data and co-ordination messages. In order to achieve efficient use of the screen, a user is able to select more than one independent Traffic Situation Presentations, thus permitting a main display of the area of responsibility plus auxiliary displays showing inbound traffic flows.

9.18.3 Meteorological Information Presentation

The Meteorological Information Presentation permits authorized users to enter aerodrome and area meteorological forecasts, to use in the processing of flight data and to display as auxiliary information for ATC. At certain working

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positions (e.g. in the APPs), the meteorological information of certain aerodromes may be permanently displayed. Therefore, any change to the information is immediately displayed and highlighted to the ATC for acknowledgement. The Meteorological Information Presentation also provides a means for authorized TMCS' operators to manually view and repair meteorological messages that were not processed automatically.

9.18.4 Aeronautical Information Presentation

The Aeronautical Information Presentation permits authorized users to enter aeronautical (environment) information and NOTAMs, to use in the processing of flight data and to display as auxiliary information for ATC.

The Aeronautical Information Presentation also provides a mean for authorized TMCS' operators to manually view and repair aeronautical messages that were not processed automatically and other unrecognized messages.

9.18.5 Paged Information Presentation

The purpose of the Paged Information Presentation is to provide a flexible mechanism by which data can be organized to display as supplementary information to ATC and other TMCS' operators, replacing the traditional array of dedicated displays and charts. As such, it brings together system environment data, configuration data, and text/graphical information compiled specifically for the Paged Information Presentation.

The layout of the pages is defined in the Maintenance and Analysis Mission by use of the Interface Editor. It may contain a mix of environment and configuration data together with prepared text or graphics. Pages are selected for display by means of an index. Additionally, a page may be linked to an object, in which case the page may be selected by simple designation on the object wherever it is displayed. For example, by clicking on an aerodrome symbol on the situation display, a page providing the meteorological information at that aerodrome may be displayed.

Update of the data is available, according to access rights, via the pages of the Paged Information Presentation, or via the other dedicated displays.

Any change to the data that is displayed on a page immediately causes the page to be updated with the new data. Additionally, users may be notified of the arrival of important information via a warning facility.

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9.18.6 Operational Status Presentation

Each TMCS' operators requires information regarding the operational status of the system, in terms of the available functionality, and other miscellaneous information (time, QNH, etc.). The particular items displayed may be customized for the particular TMCS' operators.

9.18.7 HMI Functional Capability

The HMI will be able to configure in both off-line by adaptation and on-line by authorized user. For off-line, adaptation will allow decoration and layout of push-buttons/menus, definition of the maps, default range and offset, definition and layout of the plot and track labels, preferences and manipulation of jurisdiction along with a set of functions defined on a jurisdictional basis and role, the electronic flight strips, and the layout of paper flight strips etc.

For on-line, roles and jurisdictions are modified on-line enabling associated functions to become accessible based on the pre-planned off-line adaptation. In addition, authorized user can modify certain parameters within a defined roles and jurisdiction function set and save those changes as either personnel or system wide preferences.

9.18.8 Input Optimization

Input optimization allows ATC to perform some repetitive tasks directly from the data block. In addition, the generally accessed functions that are not available from the data block have been mapped to quick action keys, allowing rapid display and removal when not used. Data block layout and functions along with quick action key mappings can be modified.

9.19 FDO HMI

The FDO will have the full capabilities of managing ATS messages and flight plan data to ensure flight data correctness and completeness of each flight plan for smooth transition of flight progress. The FDO will have the ability of managing specific dynamic aeronautical data by modification, creation and cancellation of the data as appropriate. The FDO will be able to manage weather data including meteorological messages. The FDO will provide flight data lists which are able to access all records concerning messages, actions and flight plan histories of each flight plan. The FDO

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will be able to input free text concerning for individual flight plans to display in relevant Flight Data Block, Electronic Flight Strip and Flight Data List.

9.20 Data Set Management

The Data Set Management function (DSM) will provide the facility to authorized user in order to preparing/define data set, and then to ensure consistency as the data is propagated through the system. The intention is that a static environment data is entered once and then used by many functions (e.g. CWS's Maps, FDP, and Monitoring Aids).

9.20.1 Data Set

The data set is set of static environment data. It should be grouped in many categories depend on the system environment such as Operational (OPS), Training (TRA) and Contingency (CON), etc.

The data set should comprise of the following data, but not limited to:

- a) Points or Fixes;
- b) Airports and runways;
- c) SIDs, STARs;
- d) Airways;
- e) Aeronautical maps;
- f) Airspace zones and sectorisation;
- g) QNH areas and related QNH parameters;
- h) Aircraft performances;
- i) Aeronautical information data;
- j) RPL;
- k) Surveillance data process parameters;
- l) RADAR parameters;
- m) ADS-B parameters;
- n) MLAT/WAM parameters;
- o) Flight data process parameters;

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- p) Safety nets areas and parameters;
- q) Monitoring Aids parameters;
- r) Medium Term Conflict Alerts parameters;
- s) Record and Replay parameters;
- t) Air-Ground data link parameters;
- u) ATC HMI parameters;
- v) ATFM parameters;
- w) AMAN, DMAN parameters;
- x) Airspace Management parameters;
- y) External interface parameters and
- z) Exercise preparation.

9.20.2 Management

The DSM will provide the facility to manage the data set in order to tailor the system for local condition and operational characteristics, such as creating, viewing, modifying, deleting, printing and distributing data set.

9.20.3 Import AIXM data

The DSM should provide the facility to import the aeronautical data in AIXM messages format from manual insert via USB flash drive and automatically import from Other Systems.

9.20.4 Backup and restore data set

The DSM will provide the facility to backup and restore data set to/from archive media and/or removable storage media such as USB flash drive as following:

- a) Backup a category or all data set;
- b) Restore a category or all data set; and
- c) Replicate a category or all data set.

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9.20.5 Map Generator

Map generator is the map editor used to construct and prepare map data for the TMCS. Aeronautical maps generated by the map generator can be used by various systems for the CWS display and/or PSP display.

Map generator should be able to construct types of following map:

- a) 2D maps for related aeronautical maps;
- b) 3D maps with the intention of displayed the airspace zone.

9.20.6 Data set distribution

The DSM will provide the facility to upload data set to all related system/function and activate all of them to use the new data set.

9.21 Network Management System

The aim of Network Management System function (NMS) is to provide, at minimum, the following features:

- a) Network resources monitoring, such as link bandwidth monitoring, etc.;
- b) Route analytics, such as analyze route and structure of operation network;
- c) Network configuration management;
- d) Fault management;
- e) Performance management, such as delay management, throughput management, etc.

Third party NMS application should be encouraged to perform NMS feature in order to enhance management of specific network equipments/resources such as Cisco switches and routers, etc.

9.22 Control and Monitoring System

The Control and Monitoring System function (CMS) provides the facility to authorized user in order to monitor and control the functionality and system devices of TMCS. This activity will ensure that the overall of TMCS is available to users for a high percentage of the time. In addition, CMS also performs the logging all activities that affected to the system.

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The graphical presentation on CMWS screen assists the TECHSUP and MTN to visualize the situation more easily and manage the situation more effectively using manual control. The color scheme will be used to show different status of TMCS in real time.

Both aural and visual alarm indications will be provided upon detection of equipment fault and/or any out-of-tolerance parameters in the monitoring circuits. The authorized user will be able to acknowledge the aural alarm to mute the sound. The visual alarm will remain on CMWS until the fault is resolved.

9.22.1 System Control

The CMS will provide the facility to authorized user to control functions, external interfaces of TMCS as follow, but not limited to:

- Manual redundant servers switchover;
- Manual redundant external input switchover;
- Inhibit, exhibit data line inputs;
- Manual Start, Stop function such as SDP, FDP, etc.

9.22.2 System Monitoring

The CMS will provide the facility to monitor the functions, devices, internal networks and external interfaces of TMCS as follow, but not limited to:

- Functions status such as SDP,FDP, etc.;
- External interfaces status including channel in used, channel problem, etc.;
- Internal network status including network equipment such as switches, router, etc.;
- GPS time server status and time synchronization status; and
- Performance Monitoring such as CPU, Memory, Storage, Network utilization, etc.

The Simple Network Management Protocol (SNMP) usage should be encouraged for CMS function.

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9.22.3 Logging

The CMS function will log all events that affect to the system such as redundant servers switchover, etc. then store in CMS log files.

The CMS log file will be automatically generated and recorded on a real-time basis with a UTC timestamp. The CMS log files should be able to keep 30 days as a minimum.

9.23 Contingency/Training System

This section describes the Contingency/Training System (CON/TRA) function which supports the CON/TRA concept as described previously in System Architecture.

9.23.1 The CON/TRA in Contingency mode

The CON/TRA in Contingency mode (CON) is a scaled down copy of the MOPS with the same capability but with a reduced set of hardware configuration. The CON/TRA in CON should enable ATC to perform their duties during a contingency situation.

The CON/TRA in CON will include but not limited to the following:

- Tasks and functionality as in the MOPS; and
- Performance and reliability as in the MOPS.

The CON/TRA in CON needs to be connected to the same surrounding world as the MOPS. This will make The CON/TRA in CON an ideal location to test new software versions and datasets. When performing this kind of testing it is important to ensure that information is not inadvertently sent from The CON/TRA in CON to any unintended locations.

9.23.2 The CON/TRA in Training mode

The CON/TRA in Training mode (TRA) uses a similar operational segment as the MOPS. For training purposes it is therefore required to have the fallback functionality provided together with the MOPS in order to enable students to practice a gradual method of system degradation.

The training function of CON/TRA in TRA is a high-fidelity air traffic simulator that is designed to provide realistic ATC training in an environment that accurately replicates that which ATC will experience.

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The training function will include sessions, game, and exercise as described below:

- **Sessions:** A Session defines the operational context during training. A session includes information about an entire FIR with adjacent airspace structures of initial wind and temperature profile, internal and external control units/sectors/Letters of Agreement, aircraft types and their performance profiles as well as surveillance and communication sites with type/coverage profiles, etc.
- **Game:** A Game defines the flight plans and events template or templates, and always connects to a specific Session. A Game is loaded in preparation for performing one or more Exercises. One Game template can be used for several Exercises and started at different times. Each time an Exercise is started based on a specific Game, a unique Exercise record is created that belongs to that Game.
- **Exercise:** An Exercise is always based on a Session/Game template and the result of a Game being run from start to stop is an Exercise. An Exercise contains not only the same prepared initial data set as defined by the Game, but it is also based on a unique log of all flights, events, keystrokes and voice input that occur during the running of that specific Exercise.

The CON/TRA in TRA also includes these features:

- a) Traffic and Event Generator (TEG);
- b) Pseudo Pilot (PSP); and
- c) Training Mission Control (TMC)

9.23.2.1

Traffic and Event Generator

The TEG feature will simulate all inputs to TRA as follows, but not limited to:

- Flight creation for creating of the corresponding aircraft and flight plan;
- Flight plan messages generation;
- Aeronautical information data handling;

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- Wind and Weather data generation;
- Aircraft simulation for aircraft trajectory initialization and management of the aircraft trajectory;
- Surveillance data simulate such as RADAR, ADS-B, MLAT/WAM.
- CPDLC message handling ;
- Time management.
- Report generation;

9.23.2.2 Pseudo Pilot

The PSP feature will allows commands to be sent to the TEG to control the simulation for individual aircraft. The PSP feature has two major purposes:

- Maintain realistic air traffic situations; and
- Simulate the pilot-to-ATC communications.

The main PSP actions are:

- Modify aircraft heading, flight level and speed;
- Switch an aircraft from automatic to manual piloting mode ,vice versa;
- Take-off / Landing Aircraft ;
- Create and delete aircraft;
- Modify SSR code, Aircraft ID;
- Amend to the aircraft route;
- Hold aircraft;
- Input of complex maneuver commands - ILS, VOR/DME flying;
- Requests for simple or complex reports; and
- Perform CPDLC exchanges with the ATC.

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9.23.2.3 Training Mission Control

The TMC feature controls the overall simulation environment (e.g. manage session, game, exercises). It controls the individual exercises and allows instructors to modify exercise parameters and simulation of system failures.

The main TMC commands are, at minimum:

- Start and end simulation;
- Assign of the TRN to a group;
- Start and stop exercises;
- Pause and resume exercises;
- Record an exercise;
- Replay an exercise;
- Change speed of an exercise;
- Create/Modify wind/weather data;
- Create/Modify the QNH; and
- Simulate individual surveillance data failure (e.g. RADAR, ADS-B and MLAT/WAM).

9.24 Computer Based Training Software

The Computer Based Training (CBT) is a self-learning platform of the functions, features, capabilities and usage of the TMCS as well as background information on CNS/ATM technologies such as ADS-B , CPDLC, AIDC and ADS-C etc. The CBT will include at least the following features:

- a) Management of user-defined learning packages comprising of a number of learning units and the training records ;
- b) Delivery of the learning package, each comprised of a number of learning units, to different groups of learners ;
- c) Delivery of the different packages to different groups of learners selectable by the trainer on removable storage media;

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- d) Evaluation of the learner's understanding on each of the learning unit contained in a package through computer based assessment;
- e) Provision of question pools and assessment tools to evaluate the overall understanding of the TMCS for different groups of learners;
- f) Management of security and information access based on configurable user profiles with different levels of access privileges including administrator, trainer and different groups of learners; and
- g) Provision of graphical user interface for the administrators and trainers to manage the security, access to the learning packages, learning units and training records.

9.24.1 The learning packages

The learning packages will be developed in accordance with the following requirements:

- a) The content will cover the full TMCS functions, features, capabilities and usage including at least:
 - o System architecture;
 - o The Level of Contingency and backup;
 - o Intersystem Connection;
 - o Operator Roles and Workstations;
 - o VCCS;
 - o System Functionalities;
 - o HMI including at least:
 - Maps;
 - Track and Label presentation;
 - Window management;
 - Support tools;
 - Surveillance menu and picture;

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- Flight plan management;
 - System Monitoring;
 - System message management.
- b) In addition, a number of learning units in relation to the background and/or technical aspects of CNS/ATM technologies will be applied to the CBT such as:
 - CPDLC;
 - AIDC;
 - ADS-B;
 - Mode-S;
 - MLAT/WAM;
 - ADS-C.
- c) The content will be organized into learning packages according to the training needs of different TMCS's roles of learners.
- d) Each learning package will comprise a number of learning units considered necessary for each TMCS's roles of learners. Assessment questions will be given at the end of each unit.
- e) Each learning package will be organized structurally according to the training needs of the TMCS's roles. This will include at least:
 - objective;
 - general overview of the relevant TMCS functions;
 - system configuration;
 - operational concept and service modes;
 - in-depth usage of each of the relevant TMCS functions; and
 - fallback and recovery functions.
- f) The learning units will provide simulation or animation that will demonstrate the HMI interactions and the use of menu, button and computer-aided means to perform the TMCS functions.

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9.24.2 The Training Records

The training records will be managed with learning progress and history for at least 1,000 learners in accordance with the following requirements:

- a) Record the learning details of each learner including the learner's profile, timestamps of log in and out of each learning session, the access duration of each learning unit, details of learning assessment, and other training related information;
- b) Enable the trainer to select, view and print the training records; and
- c) Enable the learner to view and print their training records.

9.24.3 Security

The security measures against data alteration, unauthorized access, intrusion and malicious computer attacks, and infection from computer virus and malicious software will be offered. All successful entries and intrusion attempts for viewing and printing by the administrators will be recorded.

9.24.4 Computer-based assessment

Computer-based assessment for each learning unit of a package will be provided in accordance with the following requirements:

- a) The assessment questions provided at the end of each learning unit will be suitable for evaluation of the learner's understanding to the content of the unit;
- b) Multiple choice and/or true-or-false style questions will be provided; and
- c) Result of the assessment will be presented to the learner at the end of the assessment.

Apart from the assessment given at the end of each learning unit, a separate question pools and assessment tools will be provided by the CBT in assessing the overall understanding of different TMCS's roles of learners according to the following requirements:

- a) A question editor for trainers to create, modify and delete the questions in the pool;

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- b) A tool for trainers to create new test papers by selecting questions from the question pools;
- c) A tool for trainers to configure the passing mark of the test paper generated; and

9.24.5 Web based supporting

The CBT should provide learning packages, computer-based assessments, and training records for web-based learning based on the Sharable Content Object.

9.25 Tower Surveillance Data Processing

For airport with high traffic movement, Tower system level III, IV (Suvarnabhumi, Donmaueng, Chiangmai, Hatyai, Phuket, Nakornsithamarat, Samui and Udon Thani) , AEROTHAI requires the Tower Surveillance Data Processing function (TSDP) which includes Advance Surface Movement Guidance and Control Systems (A-SMGCS), following the A-SMGCS Manual (ICAO doc 9830). With A-SMGCS, TSDP will be able to support airport surveillance, routing, guidance, and control to all aircraft and vehicles on the runways, taxiways, aprons and the movement area at the airports, and to support optimized “Gate to Gate” operations concept.

The surveillance functions will provide accurate information on the position and identity of all aircrafts and vehicles operating on the movement area. This will be used to enhance the automated functions associated with conformance monitoring and conflict alert. Also, the surveillance information will be useful in refining the traffic planning functions associated with predicting taxi throughput and arrival/departure times.

The automated functions will include the monitoring of conformance with taxi instructions and the detection of potential conflicts and their resolution. Automation will also be used to control ground visual aids based on ATC and surveillance inputs. Thus, the ground visual aids will be set up for the runway configuration in use, and runway/taxiway intersections will be controlled based on precise knowledge of the location and movement of aircraft and vehicles.

The Surface traffic planning automation functions will be integrated with approach/departure operations. For arrivals, the sequence for each runway and stand assignment will be used to make accurate estimates of arrival times at the stands. This information will improve aircraft handling and turn-around time. For departures, engine start and push-back times can be coordinated and managed to gain optimum

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departure sequencing, taking into account the planned route. Also, aerodrome configuration changes will be timed and implemented more efficiently, thereby minimizing any impact on the aerodrome utilization rate.

The TSDP will send/receive data from the Tower Flight Data Processing function (TFDP) in order to provide FPLs correlation with the tracks and information support automated function.

The TSDP will provide the following basic features at a minimum:

- a) Surveillance;
- b) Control;
- c) Routing (for Suvarnabhumi only);
- d) Guidance (for Suvarnabhumi only);

9.25.1 Surveillance Feature (SUF)

The SUF will provide identity and position of all traffic, with an adequate update rate to give continuous traffic information which will include speed and direction.

The SUF will be able to receive and process plots, tracked plots, weather information, status information from several types of data formats which comings from various types of interface, as listed in the table (Tower System – Surveillance Systems Information Exchange Description) at a minimum.

The systems will combine surveillance data from several sources to provide a single target with flight identification (ID) or vehicle ID for display to Tower Workstation.

The combine (fusion) algorithm will be designed to develop “seamless coverage” between Aerodrome control and Approach control, a single picture combining all data sources and maintaining track ID continuity.

Updated track and identification data for each system track will be provided to the Tower Workstation at least once per second.

The SUF will output the data in the ASTERIX format. The provided output data will contain, at minimum, as follows;

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- Track Unique Identifier
- Fusion Identifier
- Contributing sensor information
- Track Position in Cartesian co-ordinates
- Track Velocity in Cartesian co-ordinates
- Position standard deviation
- Velocity standard deviation
- Height
- Heading
- Size
- Mobile type
- Mode-S code
- Mode-A code
- Call-sign
- Registration Mark

9.25.2 Control Feature (COF)

The COF will monitor the situation on the aerodrome surface and provide alerts when particular situations are detected.

The monitoring and alerting will be provided by the system upon detecting runway incursions, taxiway alert situations and other hazardous scenarios, and generating alerts to the ATC and possibly directly to the involved pilots and/or vehicle drivers.

The COF will provide information to assist in warning ATC as follows:

- Monitoring of aircraft and vehicles on the maneuvering area for compliances with clearances and instructions;
- Determining that a runway is clear of traffic prior to a landing or take-off;

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- Providing information on essential local traffic on or near the maneuvering area;
- Determining the location of aircraft and vehicles on the maneuvering area;
- Providing directional taxi information to aircraft when requested by the pilot or deemed necessary by the ATC.
- Providing assistance and advice to emergency vehicles

The COF will be responsible for automatic conflict detection and alerting. It will detect area incursion conflicts at a minimum, comprised of;

- Runway Incursions, (e.g. conflicts between aircraft or vehicles on the runway and aircraft intending to land)
- Taxiway Conflicts, (e.g. aircraft taxiing with excessive speed)
- Area Conflicts, (e.g. an aircraft through into closed runways)
- Special Conflicts, (e.g. an aircraft through an activated stopbar)

When COF detects a conflict situation an alert message and audible alarm will be provided to the related ATC.

The TSDP will provide alerts updates to the ATC at a minimum of once per second.

The parameter of detection of conflict alert will be configurable (e.g. range, time, etc.)

9.25.3 Route Planning Feature (RPF) (for Suvarnabhumi only)

The RPF will provide fully automated strategic and tactical planning of movements to optimize the use of runway and taxiway resources and minimize taxi times.

The RPF will determine and assign routes to individual aircraft and vehicles on the movement area.

The RPF will accommodate ATC with the capability to manually select the routes for each individual flight.

The RPF will be designed with the capability to modify the assigned route by ATC and to display the selected route after ATC selection of the track.

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When the system interface with Air Field Lighting System (AFL) for airfield lighting control the route is chosen in such a way that routing functionality will be performed.

9.25.4 Guidance Feature (GDF)

The GDF will provide the guidance to the pilot during taxiing. This guidance is realized by the integration with the AFL to control and monitor stop bars and taxiway centreline lights.

The airfield lighting status for the taxiway centreline lights and stop bars on an airfield lighting segment basis is presented in term of on/off status and availability/alarm status. The presentation will be configurable colour-coding for the different indications.

When system start-up or restart, the status contained in the airfield lighting system database will be downloaded and presented on the displays. Updates received from the airfield lighting system will be presented without undue delay of receipt.

To facilitate the GDF, the system will be provided with the following capabilities:

- Interfaces with the AFL via the Gateway.
- Monitor and control the Stop bars and Taxiway Centerline Lights;
- Allow the ATC to activate and de-activate by manual or automatic controls of Stop bar and Lighting Segment;

9.25.5 Aerodrome Features Mapping

Aerodrome Name	ICAO location Indicator	SUF	COF	RPF	GDF
SUARNABHUMI	VTBS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DONMAUENG	VTBD	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
CHIANGMAI	VTCC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
HATYAI	VTSS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
PHUKET	VTSP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

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Aerodrome Name	ICAO location Indicator	SUF	COF	RPF	GDF
NAKHON SI THAMARAT	VTSN	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
SAMUI	VTSM	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
UDON THANI	VTUD	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

9.26 Tower Flight Data Processing

In order to support “gate-to-gate” operation, AEROTHAI requires the Tower Flight Data Processing Function (TFDP) to provide an operational display of flight data and vehicle data and auxiliary data (e.g. Navigation Aids status).

TFDP should process/display the necessary flight plan data and provide the status changes and key events for both IFR and VFR traffic.

TFDP should provide a Tower Electronic Flight Strip (TEFS) use in an airport environment including aprons, taxiways, runways, and Terminal control area (TMA), to replace the usual paper flight strips with centralized information system.

TFDP should provide all necessary information to ATC simultaneously, data from other information sources (e.g. from/to AIMS) are incorporated seamlessly reducing the effort for manual input and further amendment. All updates are automatically distributed to other systems (e.g. APP System, NAS) if necessary or where applicable, to provide silent co-ordination between Tower – Approach – Area Control.

9.26.1 Data Management and Update

The TFDP should provide a database, which stores and processes flight plan data and other flight related information for the purpose of track identification and labeling. The TFDP should correlate registry information, and respective flight plan information.

TFDP should store, processing and displaying FPLs, vehicle data and auxiliary data.

The TFDP should send/receive FPLs data form FDP.

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The TFDP should transfer the aircraft to Approach Control by manually or automatically when that aircraft take off.

The coordination between TFDP and FDP, the system should provide fully silent coordination for all inbound and outbound traffic from the FDP to TFDP and vice versa.

Dependent on operational flight plan status or any other flight plan data available, The TFDP should perform the following, at a minimum:

- Distribute flight plan update messages automatically without ATC intervention;
- Inform the ATC by notification to verify and manually accept or reject the update message;
- Provide alert or warning messages, for critical changes to flight plans;

9.26.2 Runway Determination

The calculation of Estimated Take-off Time (ETOT) and Estimated Time of Arrival (ETA) depends frequently on the runway configuration to be used for take-off and landing in the meteorological conditions pertaining at the time.

When the departure or arrival runway for a given flight changed, the following should be calculated, at a minimum.

- Estimated Off-Block Time (EOBT)
- Estimated Take-off Time (ETOT)
- Standard Instrument Departure (SID)
- Standard Arrival Route (STAR)
- Estimated Time of Arrival (ETA)
- Estimated Parking Time (EPT)

9.26.3 Correlation with Surveillance Data

Track Labels are required to show information derived from the equivalent flight plan or abbreviated flight plan. In particular, the flight identification is required to be displayed in almost all cases. Data is required to be made available to

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enable such correlation, which is required for both airborne flights and ground movements where available.

9.26.4 SSR Code Assignment/Management

The TFDP should provide the SSR code assignment / management function used to adapt code allocating SSR codes automatically to flight plans at their time of activation. The function should also support the manual allocation of codes.

9.27 Tower Controller Workstation(T-CWS)

The Tower Controller Workstation (T-CWS) should form the Human Machine Interface (HMI) between the operator and the system, it should be designed to provide an appropriate functionality to accommodate the operational role of Tower Controllers and supported roles, which are generally divided into three (3) main functionality as Air Situation Display (ASD), Ground Situation Display (GSD), Flight Data Display (FDD), and two (2) support functionality as Tower Dataset Operator (T-DSO), Tower Control and Monitoring (T-CMS)

9.27.1 Air Situation Display (ASD)

The ASD should provide a reliable display of the actual air traffic situation superimposed on the synthetic maps to the Tower Controller. Usually ASD is used to monitor air traffic situation. It is preferable for The ASD HMI to be similar to CWS HMI for EC APP in order to give ATC familiarity with the display and HMI function.

In case of the servers fail, the ASD should receive data directly from any surveillance sources by automatic preset or by manually.

9.27.2 Ground Situation Display (GSD)

The Ground Situation Display (GSD) should provide to Tower Controller the situation awareness about ground traffic as far as surveillance, control, planning and guidance functions are concerned. Ground tracks, should be provided with labels for target identification and flight plan information acquisition, and should be presented on the airport map. Movement safety should be supported by conflict alert messages presentation. Arrival flights and Departure flights with route presentation will be confirmed and/or modified by ATC.

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ATC should be able to command lighting statuses presentation on airport map and light segment in order to perform guidance of outbound and inbound traffic (when connect to AFL).

In case of the servers fail, the GSD should be received data directly from any surveillance sources by automatic preset or by manually.

The following information should be presented, but not limited to, at the GSD.

- Synthetic traffic situation on the digital map of the airport;
- High resolution Radar raw video from SMRs;
- Ground popup views and pre-selected areas;
- Labels attached to object track;
- Information on selected tracks;
- Arrival and Departure lists;
- Alert information;
- Guidance information;
- Route planning information,
- Maps displaying.

The GSD should be possible to set the configuration to display multiple-view layout.

The GSD should be provided tools to operators, but not limited to, as follows:

- Rearrangement of the screen
 - In-Out screen zooming,
 - Set/reset the screen center,
 - A set with predefined screen layouts including range,
 - Center and Orientation,
 - Scenario rotation, in steps of 1 degree
- Switching any map overlays,
- Bearing / Distance line

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Target Presentation

The Target presentation is synthetic information and/or digitized radar video. Tracks should be classified as Arrival, Departure and Vehicle, tracks colors should be different depend on the track classification.

Label Presentation

The track label should contain of basic flight data following ICAO Doc4444. The data containing should be different depend on track classification. The label presentation should be allow to configurable, but not limited to, as follows:

- Label color and label background color,
- Character size,
- Label layout,
- Label connection,
- Label movement.

Displaying Customization

The GSD should provide map creation/modify tool to create and modify geographical map presentation. The GSD should allow customization, but not limited to, as follows:

- Graphical symbols,
- Tracks trajectory,
- Label information,
- Angle of scenario.

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9.27.3 Flight Data Display

The Flight Data Display (FDD) should retrieve data from TFDP server and display the information on the display. The FDD is a Tower Electronic Flight Strip (TEFS) used in an airport environment including aprons, taxiways, runways, and airspace (TMA). The FDD should be touch sensitive LCD monitor for TEFS with stylus pen as the input device.

The FDDs should provide the following features, but not limited to, as follows:

- Display and process of flight plan data and vehicles data,
- Display of Notification,
- Display of Auxiliary data
- Display and process of the DMAN function,
- Display and process of runway in use,
- FDD degraded mode,
- Grouping / Regrouping of roles,

Display and process flight plan data and vehicles data

The FDD should be divided into bays representing different categories of data, but not limited to, as follows:

- Traffic lists,
- Notification windows,
- Auxiliary information windows.

Bay configuration of FDD should be configurable for each role.

The FDD should provide function to Find/Modify/Create FPL and Vehicle. All displays should be automatically updated when a flight plan is modified by an operator or by an external source.

The FDD should have two (2) types of strip bay for managing flight data as follows:

- The compulsory strip bay,

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- The non-compulsory strip bay.

The non-compulsory strip bay should be assigned to LCL and GND roles, to manage flight strip by free placement using drag and drop.

The compulsory strip bay should be assigned to other roles (e.g. T-TACTSUP), in order to automate management of the flight strip to the appropriate place according to its state transition. Whenever the LCL or GND changes state of flight, the flight state in the compulsory strip bay should be automatically updated.

The formatting of flight strip should consist of ICAO flight plan fields. The Layout, Font, Color, Commands should be configurable.

Each TEFS should be selectable to display at least three (3) formats as follows:

- Abbreviated strip format,
- Normal strip format,
- Expanded strip format.

The FDD should provide a set of control buttons and change state buttons to change state of flight for the selected FPL. The FDD should support handwriting on tactical screens with stylus, it should possible to maintain and transfer handwritten symbols or text between different operators.

The Free Text Insert (FTI) should be named using free text. The operator should be able to create, modify and delete FTI. The FTI should be able to place and move manually inside the workspace.

The notification display

The FDD should provide a notification bay to present different type of messages, at a minimum, as follows:

- Message notes exchanged between different roles
- Error messages
- Warning messages

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- Etc.

When a new notification is created, it should be sorted into a list of pending messages according to the message category and the time. Some of the messages will attract the attention of the operator with an aural signal (depend on configuration). The system should allow the operator to explain a full message from a list to display in a pop-up window, when the operator accepts the message the pop-up window will be closed. The system should allow the operator to create and exchange of message notes in free text between different roles. A dedicated note window is used to enter the message to be dispatched to the selected roles

The auxiliary data display

The FDD should provide essential information to the operator to make the right decisions knowing that priority is given to the flight data display. The windows should be displayed either permanently on the FDD or invoked on demand on the FDD.

The FDD should provide an auxiliary data to display, at a minimum, as follows:

- Current date and time
- NAVIDS status (if available)
- CATIS (if available)
- QNH value (if available)
- System status (e.g. status of server)
- Etc.

Runway in use management

The FDD should manage and display the assignment of runway configurations as departure and arrival flights for each aerodrome, to provide automatic reassignment of SID/STAR when a change of runway in use comes into effect and indicate automatically reassign SID/STAR in the database, TEFS and flight data list of the relevant flight plans.

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FDD degraded mode

In case of TFDP and/or network fails, the FDDs latest screen content should be displayed to maintain operations; the operator should be able to print out of all active and pending FPLs via color laser printer.

In case of the failure of external systems and/or communication with external systems, the operator should be able to manual input facilities for the missing data.

Grouping / Re-grouping of the roles

The system should allow T-TACTSUP to combine/split the role according to the appropriate situation. The configurations include multiple roles such as LCL+GND, LCL+GND+DCL, etc.

9.27.4 Tower Dataset Management (T-DSM)

The T-DSM should be similar to the DSM (para 9.20)

9.27.5 Tower Network Management System (T-NMS)

The T-CMS should be similar to the NMS (para 9.21)

9.27.6 Tower Control and Monitoring System (T-CMS)

The T-CMS should be similar to the CMS (para 9.22)

10 Technical Characteristic

This chapter describes the physical characteristics of the system in terms of its components, its performance, and certain design principles to be followed.

10.1 Workstations Characteristic

All types of Workstation should be equipped with at least the following devices:

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- a) Workstation-grade Computer;
- b) LCD Monitor; and
- c) Input Device.

10.1.1 Workstation-grade Computer

All Workstation-grade Computer will be high performance computer equipped with at least the following high availability features and devices:

- a) Intel Xeon or AMD OPTERON CPU;
- b) RAM with error correction ECC;
- c) Dedicated Graphic Card;
- d) Multiple dedicated gigabit network interface cards;
- e) Mean Time Between Failures (MTBF) > 30,000 hours; and
- f) Redundant power supplies (if available).

10.1.2 LCD Monitor

10.1.2.1 LCD Monitor of Type A Workstation

LCD Monitor of Type A Workstation consists of one (1) 2k x 2k LCD Monitor and one (1) 24" portrait orientation LCD Monitor.

- a) The 2k x 2k LCD Monitor will have, at minimum, the following performance features:
 - Resolution= 2048 x 2048 pixels at 60Hz refresh rate;
 - Dual ports for DVI inputs;
 - Brightness ≥ 150 cd/m²;
 - Contrast ratio $\geq 700:1$;
 - Display colors ≥ 16.7 M (24bit);
 - Color temperature 7500 K typical;
 - Dual power supply;

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- Power supply operates between 100 VAC – 240 VAC, frequency range 45-65 Hz;
 - Front control module / OSD;
 - LED backlight technology; and
 - Lamp lifetime $\geq 50,000$ hours.
- b) The 24" LCD Monitor will have, at minimum, the following performance features:
- Resolution = 1200 x 1920 pixels (portrait);
 - DVI port ≥ 1 ;
 - Brightness ≥ 250 cd/m²;
 - Contrast ratio $\geq 1000:1$;
 - Display colors ≥ 16.7 M (24bit);
 - Power supply operates between 100 VAC – 240 VAC, frequency range 45-65 Hz;
 - VESA Mounting Support; and
 - LED backlight technology.

10.1.2.2 LCD Monitor of Type B Workstation

LCD Monitor of Type B Workstation will be 24" LCD Monitor and will have, at minimum, the following performance features:

- Resolution = 1920 x 1200 pixels at 60Hz refresh rate;
- DVI port ≥ 1 ;
- Brightness ≥ 300 cd/m²;
- Contrast ratio $\geq 1000:1$;
- Display colors ≥ 16.7 M (24bit);
- VESA Mounting Support;
- LED backlight technology; and

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- Power supply operates between 100 VAC – 240 VAC, frequency range 50 Hz +-3Hz.

10.1.2.3 LCD Monitor of Type C Workstation

LCD Monitor of Type C Workstation will be 30” LCD Monitor and will have, at minimum, the following performance features:

- Resolution = 2560 x 1600 pixels at 60Hz refresh rate;
- DVI port ≥ 1 ;
- Brightness ≥ 370 cd/m²;
- Contrast ratio $\geq 1000:1$;
- Display colors ≥ 16.7 M (24bit);
- VESA Mounting Support;
- LED backlight technology; and
- Power supply operates between 100 VAC – 240 VAC, frequency range 50 Hz +-3Hz.

10.1.2.4 LCD Monitor of Type D Workstation

LCD Monitor of Type D Workstation will be 21.5” interactive pen display and will have, at minimum, the following performance features:

- Resolution $\geq 1920 \times 1080$ pixels at 60Hz refresh rate;
- DVI port ≥ 1 ;
- Brightness ≥ 230 cd/m²;
- Contrast ratio $\geq 850:1$;
- Display colors ≥ 16.7 M (24bit);
- Operated with stylus pen (battery-free, cordless and with side switches); and
- Power supply operates between 100 VAC – 240 VAC, frequency range 50-60Hz.

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10.1.3 Input Device

The Input Device and Pointing Device will be composed of a three-button or two buttons with scroll wheel mouse and standard QWERTY keyboard.

Each CWS should have a maximum of one (1) keyboard and one (1) pointing device.

10.2 Server Computer

All Server Computer will be high performance computer equipped with at least the following high availability features and devices:

- a) Intel Xeon or AMD OPTERON CPU;
- b) DDR3 RAM with error correction ECC;
- c) Multiple dedicated gigabit network interface cards;
- d) Hot-plug redundant power supply units;
- e) Hot-plug hard disks installed in multi-channel hardware Redundant Array of Independent Disks (RAID) configurations;
- f) Mixed RAID configurations for RAID 1 and RAID 5; and
- g) Mean Time Between Failures (MTBF) \geq 30,000 hours;

10.3 Printers

The Networked Color Laser printers are provided to support printing needs of the users/controllers for general printing needs. (i.e., flight plan data, flight data statistics, log reports, etc.). Each printer contains an integrated LAN adapter for connectivity to the system network. The networked Color Laser printers will be high quality, quiet printing capabilities and features up to 35 pages per minute print speed (A4), up to 1200 x 1200 DPI.

10.4 Console

The console will be provided to accommodate the operation in Operational partition, CON/TRA partition of BACC/BAPC, BAPP, CMA APC, HTY APC, PUT APC, PSL APC, HHN APC and LTS/RTS. In addition, the Console for support Optional End systems will be provided as well.

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The consoles for ACC/ APP operation will be able to support one 2K x 2K LCD monitors which act as the Main display and two portrait orientation 16:10 aspect ratio 24-inch LCD monitors which act as the extended display (if available).

The displays should be mounted onto the arm using the display screen mounting brackets. The horizontal sub-arm, and brackets will be connected by slide tracks or hinges to freely adjust the inclination and swivel of display for easy viewing in the horizontal or vertical mode. In addition, the height of the displays should be adjustable using motorized mechanics. The height of the working surface should also be adjustable using motorized mechanics.

The console will be equipped the main and fallback VCCS Touch-Entry Device (TED) display include speaker, footswitch, slave clock display and appropriate number of communication socket.

The console design will minimize reflections from daylight or any other type of light source onto the screens.

To allow for the rapid replacement of the mouse/keyboard, the cable connection point(s) of the mouse/keyboard to the CWS should be easily accessible to the user without the need for technical staff intervention.

The cup holder and A4 document holder module should be provided to prevent accidental liquid spilling and for easy access to the document.

Service lights will be provided inside all equipment cabinets and equipment cabinet bay, the service lights will be controlled individually by manual switch.

Equipment cabinets will be provided to house the equipment and mounted in the rear to allow cooling, noise buffering and easy access to equipments , if installation/ maintenance is needed, without disruptions to ATC.

The consoles will have provision of airflow opening for cooling and heat dissipation effect. The airflow opening will be filtered with filter to avoid accidental entry of foreign object and to prevent dust accumulation.

Overhead or desktop work lighting will be equipped to illumination of the desktop working surface with white light LED reading lamps and fully dimmable light fixtures when desired.

Each console will be equipped with three (3) power distribution units within the console, each unit can be switched on/off and provide safe supply to all the

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consuming equipment individually. One unit will be used for Workstation, one unit will be used for VCCS TED panel and the other unit will be used for general purpose such as lighting etc.

Seats, sufficiently, maneuverable, adjustable and durable will be provided for manning all of working positions.

10.5 Reliability, Availability, and Maintainability (RAM)

Reliability, Availability and Maintainability are characteristics of the overall system which will be specified, designed, implemented, tested, validated and documented.

The methodology, techniques, processes and tools that the Tenderer intend to use to achieve the specified RAM objectives will be described or referenced in specific plans.

Reliability is the probability that an item will perform its intended function without error, under stated conditions, for a specified period of time.

Availability is defined as a ratio of the total time the system is capable of performing its mission, against the time for which it is required to perform that mission, expressed as a percentage.

Maintainability is the measure of the ability of an item to be retained in or restored to a specified condition when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair.

The Tenderer will provide in his Response RAM predictions and analysis, and also substantiate his ability to meet the specified RAM by providing in his response a RAM model consisting of RAM block diagrams covering all functions of the system.

The system will be designed to operate 24 hours a day, 7 days a week, 365 days per year.

From a cold start (power-on), as well as from a warm re-start, the servers should be configured to automatically start the application with all necessary services running in order to allow immediate use of the system.

Monitoring systems intended for operation and maintenance will be part of the technical system, making the maintenance activities more efficient thereby reducing the operation and maintenance costs.

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The Mean Time To Repair (MTTR), comprising the failure isolation, replacement and subsequent restart and performance tests, at the level of the Line Replaceable Unit (LRU) will not exceed 30 minutes.

The availability of a depiction of the current traffic situation, comprising at least a plot display from a selected source and background maps, at CWS on each suite will be at least 0.9999.

10.6 Performance and Capacity

10.6.1 System Performance and Capacity

The system will provide the following performance and capacity in the Operational and Contingency Facility at minimum:

ITEM	Performance and capacity
System Coverage Area	2048 x 2048 NM.
Height	full Mode C compatibility
Received plots per scan per radar	600
Concurrent System Tracks	1,000
Concurrent System Flight Plans in all states	5,000
Display Range	adjustable from 1 NM. to 1024 NM.
Number of tracks displayable in ASD	500
Display Graphical Maps	60

10.6.2 Response Time

The Maximum response time on commands to execution completed at CWS and T-CWS will be one (1) second with the exception of commands that involve flight plan handling (e.g. route modification) which will be four (4) seconds.

10.6.3 Start-Up and Switch-over Times

The time required for complete system start-up from cold (i.e. switched-off) such that full system capabilities are available, will not exceed 15 minutes.

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The time required for automatic switchover of a failed component of the radar processing chain (radar interfaces and tracking) will not exceed 20 seconds.

In case of server and/or network failure, the switch-over of redundant server and /or network will be executed automatically and transparent to the users without any data loss or service interruption.

The time required to configure a workstation, already powered-up and allocated to the MOPS, for complete operation at a sector will not exceed 25 seconds. The aforementioned 25 seconds will includes the time between the instant that the OPSUP enters the reconfiguration command and the instant that the reconfigured workstation is available for operational use.

The time required for complete start-up of a CWS from a powered-off state to complete operation at a sector will not exceed 5 minutes.

10.7 Design Principles

10.7.1 Hardware

All components will be commercial off-the-shelf (COTS) and be field-proven commercially available products whose performance meets or exceeds the needs for air traffic control environment.

The system will be constructed using open architecture using standard hardware and standard communication protocols.

All servers will use similar configuration such as same brand/model, etc. Also all workstations-grade computers in the system will use similar configuration such as same brand/model, etc. Therefore any equipment of server/workstation workstations-grade computer is 100% interchangeable with other equipment of the same type.

Upgrade and expansion options will be easily carried out, so as to minimize planning and System configuration effort in order to implement any future expansion.

The maximum memory usage and CPU usage of each Server and Workstation-grade computer will not exceed 50% whilst providing the maximum capacity.

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Each Hardware unit and module will be clearly labeled in English in accordance with its function, and will include a type number and serial number for identification purposes.

10.7.2 Software

The Application Software programmes will be written in a popular structured high-level language to facilitate ease of maintenance and development.

For the design and implementation of relational databases in the System, the System will use commonly used Relational Database Management System (RDBMS) software such as Oracle or equivalent.

10.7.3 Operating System

All computers will use Linux operating systems.

10.7.4 Networking Equipment

The network equipment and interface devices will utilize high bandwidth communication technologies at least 1000 Mbps e.g., gigabit network cable, gigabit switches and standard TCP/IP and UDP/IP communications protocols.

Each node of the MOPS, CON/TRA and IBS will be equipped with a dual network interface to provide redundant operational LAN connections.

Each network equipment will be equipped with at least the following networking management features and devices:

- a) Management Information Base (MIB) conforming to RFC1212 and RFC1213 and agents supporting Remote Network Monitoring (RMON) and SNMP standards;
- b) Sending the equipment status messages through SNMP by compiling MIB in conformance with RFC 3418 to the CMWS; and
- c) Synchronizing the equipment date/time clock through NTP.

Each network switch will be equipped with at least the following high availability features and devices:

- a) MTBF \geq 140,000 hours;
- b) Modular chassis designed for plug-in channel cards;

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- c) Hot-plug redundant power supply units; and
- d) Hot-plug channel cards.

Each network router will be equipped with at least the following high availability features and devices:

- a) MTBF \geq 100,000 hours;
- b) Modular chassis designed for plug-in channel cards;
- c) Hot-plug redundant power supply units; and
- d) Hot-plug channel cards.

The network switch/router will be able to enable IEEE 802.3ad link aggregation and port trunking for high availability connection to devices across multiple switches/routers.

The network switch/router will provide IEEE 802.1X Virtual LAN (VLAN)-based and port-based security features, including firewalls and Quality of Service (QoS) features.

10.7.5 Time Reference System

The Time Reference System will be used to keep time synchronization in the MOPS, CON/TRA and IBS which will establish a common time source for all systems.

In addition, outputs will exist to synchronize external systems with the common time source, such as the DVR and slave clock display on each console.

The Time Reference System will be synchronized to GPS signals received by the antenna, and it will be distributed to all net nodes by NTP through a network Ethernet instead of a serial interface. And For this purpose a duplicated GPS receiver with antenna will be provided and installed.

The system will have the capability to synchronize all systems to a common time source with a maximum deviation of 100 milliseconds.

System Mean Time Between Failures (MTBF) will be at least three (3) years.

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10.8 Uninterrupted Power Supply

The Uninterrupted Power Supply (UPS) system provides a continuous supply of electric power to systems when the power supplies at the facility are not available or stable. The UPS System should also provide high quality AC power for sensitive electronic equipment loads.

10.8.1 UPS facilities at each site

For TMCS, the UPS facilities information is provided for Tenderer for consideration. Some UPS systems have already been implemented by AEROTHAI, therefore the Tenderer may use those UPS systems for their implementation. The Tenderer is responsible for consideration whether or not the current implemented UPS is suitable for their system based on the amount of power consumption required. If the current implemented UPS is not suitable, the Tenderer will be responsible to provide the UPS for the respective systems.

However, the rest of UPS systems will be fully under the responsibility of the Tenderer. The locations of those UPS systems are provided previously in Site Information and the technical details are described in the UPS Characteristic section.

For the UPS systems under responsibility of the Tenderer, the Tenderer will provide, install, and test a complete and operable UPS in specified locations. All UPS equipment must be new and factory tested. The Tenderer is also responsible to demonstrate a complete full load field test and successful field testing the UPS compatibility with AEROTHAI emergency backup generator.

The details of UPSs at each site are as follow:

10.8.1.1 Tung Mahamek Site

The planned numbers of UPS and their respective loads at Tung Mahamek Site is described in table as follow:

System	System Description	UPS #1	UPS#2	UPS#3	UPS#4
NAS MOPS	Data Processing	X			
	VCCS	X			
	End System (3rd Floor)	X			
	End System (8th Floor)		X		
	F-VCCS		X		

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NAS CON/TRA	Data Processing			X	
	VCCS			X	
	End system				X
NAS IBS	Data Processing	X			
APP IBS	Data Processing	X			

Table 54 UPSs for Tung Mahamek system and their respective loads

The summary of UPS details required at Tung Mahamek Site is described in table as follow:

UPS #	O/P Power (KVA)	Phase Type	Type	Responsibility
1	Tenderer Proposed	Depending on Full Load Rate	Type A	Tenderer
2	Tenderer Proposed	Depending on Full Load Rate	Type A	Tenderer
3	60	3-Phases	TBP*	AEROTHAI
4	40	3-Phases	TBP*	AEROTHAI

*TBP – Information to be provided by AEROTHAI when requested.

Table 55 Summary of UPS Details at Tung Mahamek Site

Miscellaneous Electrical Components

The Tenderer will also provide Bus Duct connecting between the metro electric/engine at the ground floor of the New Operation Building to the UPS system on the 2nd and the 8th floor. Please note that there are 2 paths which require Bus Ducts; one path is outside of the New Operation Building while the other path is inside. The site survey and site evaluation of Bus Duct placement are recommended. The Tenderer will also provide static transfer switches, cables connecting UPS to equipments, main distribution board, junction box, installation materials, and other necessary components.

10.8.1.2

Chiang Mai Site, Hat Yai Site, and Phuket Site

The planned numbers of UPS and their respective loads at each of the following sites, Chiang Mai Site, Hat Yai Site, and Phuket Site, is described in table as follow:

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System	System Description	UPS #1	UPS#2	UPS#3
APP MOPS	Data processing	X		
	VCCS	X		
	F-VCCS	X		
	End Systems	X		
APP CON/TRA	Data processing		X	
	VCCS		X	
	End System		X	
LTS	Data Processing	X		
	End System			X

Table 56 UPSs for CMA APP System, HTY APP System, and PUT APP System and their respective loads

The summary of UPS details required at each of the following sites, Chiang Mai Site, Hat Yai Site and Phuket Site, is described in table as follow:

UPS #	O/P Power (KVA)	Phase Type	Type	Responsibility
1	20	3-Phases	TBP*	AEROTHAI
2	Tenderer Proposed	Depending on Full Load Rate	Type A	Tenderer
3	10	single-Phase	TBP*	AEROTHAI

*TBP – Information to be provided by AEROTHAI when requested.

Table 57 Summary of UPS Details at Chiang Mai Site, Hat Yai Site, and Phuket Site

Miscellaneous Electrical Components

AEROTHAI will provide electrical cable connecting metro electric/engine to the UPS. However, at each site, the Tenderer will provide static transfer switches, cables connecting all UPS to equipments, main distribution board, junction box, installation materials, and other necessary equipments. The site survey and site evaluation of components placement are recommended.

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10.8.1.3 Phitsanulok Site and Hua Hin Site

The planned numbers of UPS and their respective loads at each of the following sites, Phitsanulok Site and Hua Hin Site, is described in table as follow:

System	System Description	UPS #1	UPS#2	UPS#3
APP MOPS	Data processing	X		
	VCCS	X		
	F-VCCS	X		
	End Systems	X		
APP CON/TRA	Data processing		X	
	VCCS		X	
	End System		X	
LTS	End System			X

Table 58 UPSs for PSL APP System and HHN APP System and their respective loads

The summary of UPS details required at each of the following sites, Phitsanulok Site and Hua Hin Site, is described in table as follow:

UPS #	O/P Power (KVA)	Phase Type	Type	Responsibility
1	20	3-Phases	TBP*	AEROTHAI
2	Tenderer Proposed	Depending on Full Load Rate	Type A	Tenderer
3	10	single-Phase	TBP*	AEROTHAI

*TBP – Information to be provided by AEROTHAI when requested.

Table 59 Summary of UPS Details at Phitsanulok Site and Hua Hin Site

Miscellaneous Electrical Components

AEROTHAI will provide electrical cable connecting metro electric/engine to the UPS. However, at each site, the Tenderer will provide static transfer switches, cables connecting all UPS to equipments, main distribution board, junction box, installation materials, and other necessary equipments. The site survey and site evaluation of components placement are recommended.

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10.8.1.4 Suvarnabhumi Airport Site

The planned numbers of UPS and its respective loads at Suvarnabhumi Airport Site is described in table as follow:

System	System Description	UPS #1	UPS#2	UPS#3
BAPP MOPS	Data processing	X		
	VCCS	X		
	F-VCCS	X		
	End Systems	X		
APP CON/TRA	Data processing		X	
	VCCS		X	
	End System		X	
SBA LTS	Data Processing	X		
	End System			X

Table 60 UPSs for BAPP System and its respective loads

The summary of UPS details required at Suvarnabhumi Airport Site, is described in table as follow:

UPS #	O/P Power (KVA)	Phase Type	Type	Responsibility
1	Tenderer Proposed	Depending on Full Load Rate	Type A	Tenderer
2	Tenderer Proposed	Depending on Full Load Rate	Type A	Tenderer
3	Tenderer Proposed	Depending on Full Load Rate	Type B	Tenderer

Table 61 Summary of UPS Details at Suvarnabhumi Airport Site

Miscellaneous Electrical Components

AEROTHAI will provide electrical cable connecting metro electric/engine to the UPS. However, the Tenderer will provide static transfer switches, cables connecting all UPS to equipments, main distribution board, junction box, installation materials, and other necessary equipments. The site survey and site evaluation of components placement are recommended.

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10.8.1.5 Don Muang Airport Site

The planned numbers of UPS and its respective loads at Don Muang Airport Site is described in table as follow:

System	System Description	UPS #1
DMA RTS	Data Processing	X
	End System	X

Table 62 UPSs for DMA RTS and their respective loads

The summary of UPS details required at Don Muang Airport Site, is described in table as follow:

UPS #	O/P Power (KVA)	Phase Type	Type	Responsibility
1	60	3-Phases	TBP*	AEROTHAI

*TBP – Information to be provided by AEROTHAI when requested.

Table 63 Summary of UPS Details at Don Muang Airport Site

Miscellaneous Electrical Components

AEROTHAI will provide electrical cable connecting metro electric/engine to the UPS. However, the Tenderer will provide static transfer switches, cables connecting all UPS to equipments, main distribution board, junction box, installation materials, and other necessary equipments. The site survey and site evaluation of components placement are recommended.

10.8.1.6 Samui Airport Site, Udon Thani Airport Site, and Nakhon Si Thammarat Airport Site

The planned numbers of UPS and their respective loads at each of the following sites, Samui Airport Site, Udon Thani Airport Site, and Nakhon Si Thammarat Site, is described in table as follow:

System	System Description	UPS #1
Samui Airport RTS / Udon Thani Airport RTS / Nakhon Si Thammarat RTS	Data Processing	X
	End System	X

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Table 64 UPSs for Samui Airport RTS, Udon Thani Airport RTS, and Nakhon Si Thammarat Airport RTS and their respective loads

The summary of UPS details required at each of the following sites, Samui Airport Site, Udon Thani Airport Site, and Nakhon Si Thammarat Site, is described in table as follow:

UPS #	O/P Power (KVA)	Phase Type	Type	Responsibility
1	Tenderer Proposed	Depending on Full Load Rate	Type B	Tenderer

Table 65 Summary of UPS Details at Samui Airport Site, Udon Thani Airport Site, and Nakhon Si Thammarat Airport Site

Miscellaneous Electrical Components

AEROTHAI will provide electrical cable connecting metro electric/engine to the UPS. However, at each site, the Tenderer will provide static transfer switches, cables connecting all UPS to equipments, main distribution board, junction box, installation materials, and other necessary equipments. The site survey and site evaluation of components placement are recommended.

10.8.1.7

Other Category Level-II Airport Sites

The planned numbers of UPS and their respective loads at each of the other category Level-II airport sites is described in table as follow:

System	System Description	UPS #1
Category Level-II Airport RTS	End System	X

Table 66 UPSs for each of Category II Airport RTS and their respective loads

The summary of UPS details required at each of the other category Level-II airport sites is described in table as follow:

UPS #	O/P Power (KVA)	Phase Type	Type	Responsibility
1	Tenderer Proposed	Depending on Full Load Rate	Type B	Tenderer

Table 67 Summary of UPS Details at each of Category Level-II Airport Sites

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Miscellaneous Electrical Components

AEROTHAI will provide electrical cable connecting metro electric/engine to the UPS. However, at each site, the Tenderer will provide static transfer switches, cables connecting all UPS to equipments, main distribution board, junction box, installation materials, and other necessary equipments. The site survey and site evaluation of components placement are recommended.

10.8.2 UPS Characteristic

10.8.2.1 General Characteristics

In the event of power loss or electric power instability, all systems utilizing UPS System will not be affected and will not require re-start even after the power stability is resumed. Furthermore, The UPS System will have a transformer for electrical isolation between input and output with current limiting overload protection and output neutral bonded to ground. The main circuit and the bypass can use the same or different sources.

Generally, the UPS equipment comprises standalone, flame-retardant sealed, non-hydrogen producing battery units installed in the equipment room. The UPS battery unit will be maintenance-free and require no special venting.

The UPS provides a continuous supply of electric power to all equipments at each facility. There are generally two types of equipments for each site:

- Dual Power Supply Equipments; and
- Single Power Supply Equipments.

There are two (2) concepts for the UPS configuration; full UPS configuration (Type A), half UPS configuration (Type B).

10.8.2.2 Type A UPS Configuration

The conceptual diagram is presented in figure below.

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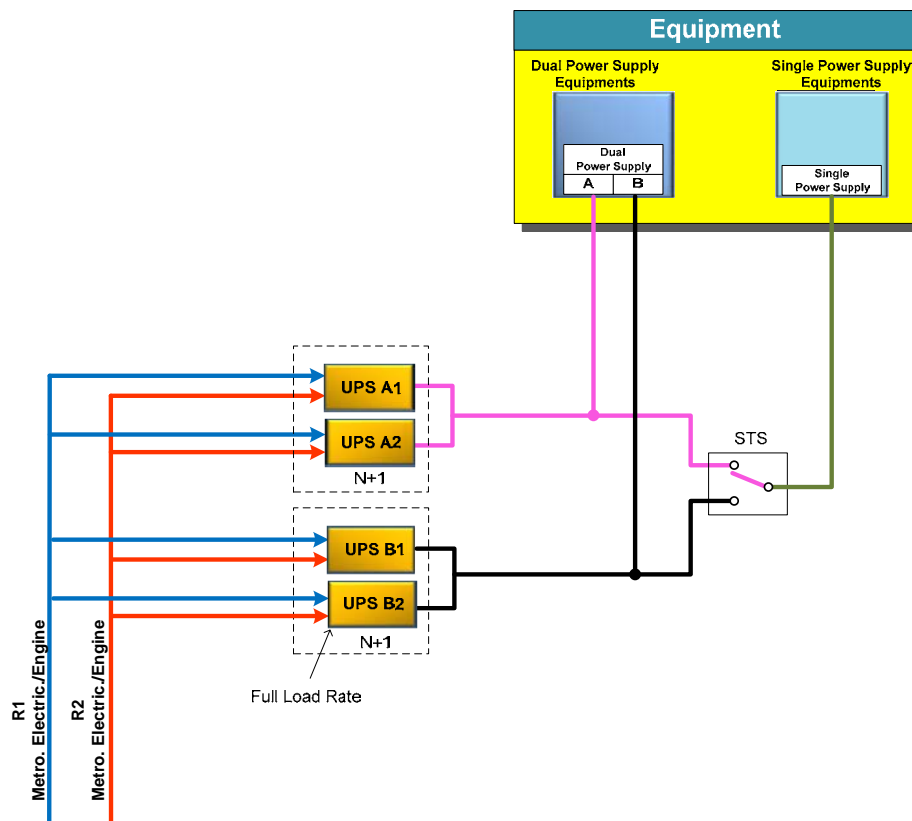


Figure 17 Conceptual diagram of full UPS configuration

In the diagram, all equipments will only receive electrical power from UPS to ensure stable electrical current. At minimum, the full UPS configuration consists of the following components:

- UPS equipment set. There are, at minimum, four (4) sets of UPS equipments (A1, A2, B1, B2). Each set of UPS equipment has 2 inputs in “separated main bypass” configuration. A1 and A2 connect with each other in Parallel redundant configuration. B1 and B2 connect with each other in Parallel redundant configuration. Both the UPS sets in Parallel redundant configuration will share the load equally. In case of failure of one UPS set, the load should get automatically transferred to the second UPS set without any operational break. Each set of UPS

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equipment, alone, is able to provide enough electric power for all equipments in the facility for a minimum of 15 minutes. The Tenderer is responsible for electric current load calculation for each facility and each set of UPS equipment. The output power of UPS will be 3-phases.

- Static Transfer Switch (STS): There is, at minimum, one (1) STS. The STS connects to both groups of UPS equipments to receive electric power supply. The STS automatically selects electric power from one group of UPS to provide to all single power supply equipments in the facility.

10.8.2.3 Type B UPS Configuration

The conceptual diagram is presented in figure below:

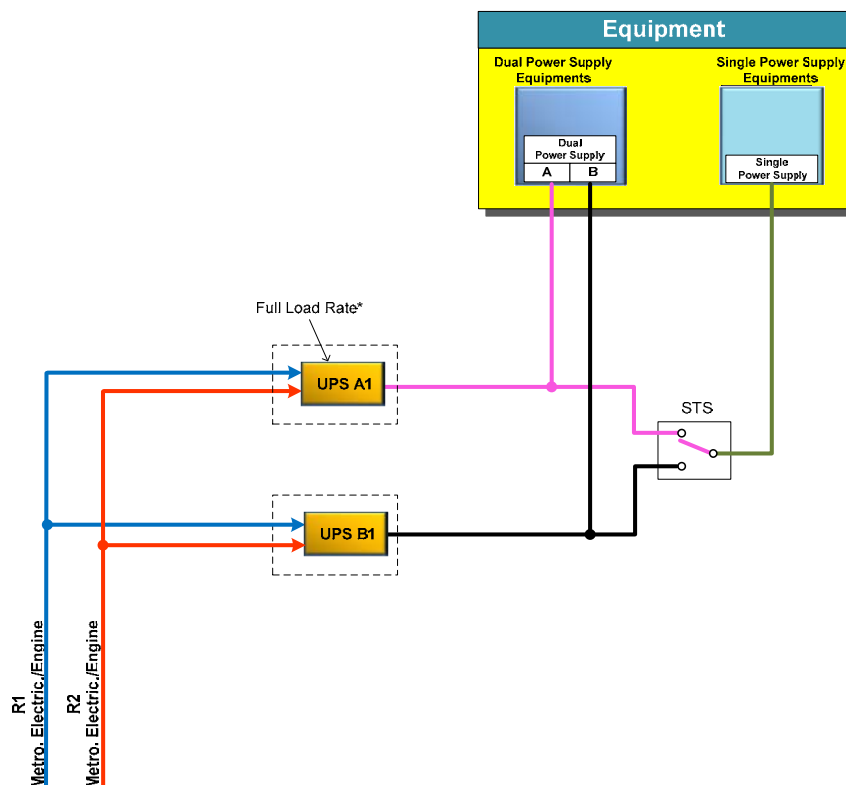


Figure 18 Conceptual diagram of half UPS configuration

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In the diagram, all equipments will only receive electrical power from UPS to ensure stable electrical current. At minimum, the half UPS configuration consists of the following components:

- UPS equipment set. There are, at minimum, two (2) sets of UPS equipments (A1, B1,). Each set of UPS equipment has 2 inputs in “separated main bypass” configuration. Also, each set of UPS equipment, alone, is able to provide enough electric power for all equipments in the facility for a minimum of 15 minutes. The Tenderer is responsible for electric current load calculation for each facility and each set of UPS equipment. The output power of UPS will be 3-phases.
- Static Transfer Switch (STS): There is, at minimum, one (1) STS. The STS connects to both groups of UPS equipments to receive electric power supply. The STS automatically selects electric power from one group of UPS to provide to all single power supply equipments in the facility.

10.8.2.4 Technical Specification for 3-phases UPS System

The minimum technical specification for 3-phase UPS System is described in following table:

Details	Criteria
TECHNOLOGY	IGBT based, Microprocessor/Digital Signal Processing based, Double Conversion On-line UPS with complete isolation from the mains through inbuilt isolation transformer protecting the load from electrical noises spike and voltage surge, with reverse phase sequence operation for three phase supply.
QUALITY STANDARD	ISO 9001 and ISO 14001 Certification
INPUT RATINGS (Rectifier/Charger Unit)	
VOLTAGE RANGE	380 to 415 V AC, $\pm 15\%$, 3Ph + N +G
POWER FACTOR	> 0.98 at full load
FREQUENCY	50 Hz ($\pm 5\%$ at least)
CURRENT HARMONIC DISTORTION	$< 5\%$ at full load
POWER WALK IN	0-100% > 5 sec

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Details	Criteria
OUTPUT RATINGS (Inverter Unit)	
POWER RATING	Proposed by Tenderer (on continuous basis)
POWER FACTOR	0.9 or better
VOLTAGE	380 to 415 V AC, $\pm 15\%$, 3Ph + N + G
VOLTAGE REGULATION	$\pm 2\%$ (static load)
FREQUENCY	50 Hz $\pm 0.5\%$ Nominal
WAVEFORM	Sine Wave with Total Harmonic Distortion < 3% for linear loads < 5% for non-linear loads
LOAD CREST FACTOR	3 : 1 without derating
OUTPUT OVERLOAD	125% for 1 minute and 150% for 30 seconds
BATTERY RATINGS	
TYPE	Sealed Maintenance Free/ VRLA
BACK-UP TIME	15 minutes on full load on each UPS
CABINET	The batteries should be housed in a suitable cabinet for user safety along with ventilation louvers.
OVERALL EFFICIENCY	> 90%
PROTECTIONS	Overload & Short Circuit at the output Over Temperature inside the UPS Over Discharge for Battery Under/ Over Voltage to the load in Normal mode Under/ Over Voltage to the load in Bypass mode Spikes & Surges to the load
AUDIBLE ALARMS	Mains Failure, Battery low, Over Temperature, Inverter Under/ Over Voltage & Inverter Overload
INDICATIONS	The UPS should be provided with Multi-function LCD Panel for monitoring & control
UPS COMMUNICATION	RJ-45 10/100 Base-T (Directly through LAN connection) using SNMP/NETCOM Card
UPS SOFTWARE	The UPS should be provided with Software compatible to Windows for real time monitoring of all the vital parameters such as Input Voltage, Output Voltage, Battery Voltage, Output Load etc. and Control the UPS using LAN connection.
ADDITIONAL FEATURES	Automatic Bypass Switch Maintenance bypass switch Display of status/ health of UPS on LCD with data logging
ENVIRONMENTAL PARAMETERS	Operating Temp. 0 to 40 degree C - Relative Humidity 0 to 95% RH
ACOUSTIC NOISE	< 75 dBA @ 1 meter

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Details	Criteria
ADDITIONAL FEATURE	The UPS System should use the most advanced Microprocessor technology and have state-of-the-art technology with high degree of reliability in operation for continuous operation 24 hrs. and 365 days a year. The UPS System will provide external connection via IP Network for external system to execute the control and monitoring feature using Simple Network Management Protocol (SNMP).
AFTERSALE SERVICE	The UPS System will have local representative/distributor who conducts regularly maintenance activities during warrantee period for AEROTHAI.

Table 68 Technical Specification for 3-phase UPS System

10.8.2.5 Technical Specification for Static Transfer Switch

The minimum technical specification for Static Transfer Switch is described in following table:

Details	Criteria
INPUT SOURCE 1 OR SOURCE 2	
Nominal Voltage (V rms)	400 V
Voltage Range	380 to 415 V AC, ± 10 % rms. (adjustable)
Frequency	50 Hz (± 5 % at least)
Number of Phase	3 Ph + N + G
Number of Pole	3 Pole (Non Switch Natural)
OUTPUT	
Power Rating (A rms)	Proposed by Tenderer (on continuous basis) and equivalent to UPS's output power rating.
Technology	Static Switch, two input sources and double maintenance bypass with interlock.
Voltage Range	380 to 415 V AC, ± 10 % rms. (adjustable)
Frequency	50 Hz (± 5 % at least)
Number of Phase	3 Ph + N + G
Number of Pole	3 Pole (Non Switch Natural)
Overload Capacity	110 % 5 minutes or better
Transfer Time	≤ 5 ms for automatic and manual transfer
OVERALL EFFICIENCY	> 90 %

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Details	Criteria
ENVIRONMENTAL PARAMETERS	Operating Temp. 0 to 40 degree C - Relative Humidity 0 to 95% RH
ACOUSTIC NOISE	< 65 dBA @ 1 meter
DISPLAY	LCD Display and Mimic Diagram

Table 69 Technical Specification for Static Transfer Switch

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SECTION C Provisional Requirements

1 System Architecture Submittal

- ARCH01: The Tenderer shall propose and detail the system architecture best suited for TMCS. [E]
- ARCH02: The Tenderer shall propose and detail the system best suited for NAS MOPS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]
- ARCH03: The Tenderer shall propose and detail the system best suited for NAS CON/TRA. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]
- ARCH04: The Tenderer shall propose and detail the system best suited for NAS IBS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]
- ARCH05: The Tenderer shall propose and detail the system best suited for APP IBS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]
- ARCH06: The Tenderer shall propose and detail the system best suited for CMA APP MOPS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]
- ARCH07: The Tenderer shall propose and detail the system best suited for CMA APP [E]

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CON/TRA. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)

- ARCH08: The Tenderer shall propose and detail the system best suited for HTY APP MOPS. [E]
(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)
- ARCH09: The Tenderer shall propose and detail the system best suited for HTY APP CON/TRA. [E]
(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)
- ARCH10: The Tenderer shall propose and detail the system best suited for PUT APP MOPS. [E]
(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)
- ARCH11: The Tenderer shall propose and detail the system best suited for PUT APP CON/TRA. [E]
(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)
- ARCH12: The Tenderer shall propose and detail the system best suited for PSL APP MOPS. [E]
(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)
- ARCH13: The Tenderer shall propose and detail the system best suited for PSL APP CON/TRA. [E]
(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)
- ARCH14: The Tenderer shall propose and detail the system best suited for HHN APP MOPS. [E]
(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)

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ARCH15: The Tenderer shall propose and detail the system best suited for HHN APP [E]
CON/TRA. (The detail should include, at minimum, a diagram showing
connections among all components such as servers components, network
components, end system components, inputs, outputs, etc.)

ARCH16: The Tenderer shall propose and detail the system best suited for the following tower [E]
systems:

- Korat Tower system,
- Takli Tower system,
- U-tapao Tower system, and
- Kampangsan Tower system.

(The detail should include, at minimum, a diagram showing connections among all
components such as servers components, network components, end system
components, inputs, outputs, etc.)

ARCH17: The Tenderer shall propose and detail the system best suited for the following tower [E]
systems:

- Phitsanulok Tower system,
- Hua Hin Tower system,
- Khon Kaen Tower system,
- Chiang Rai Tower system,
- Ubon Ratchathani Tower system,
- Krabi Tower system,
- Surat Thani Tower system,
- Sakon Nakhon Tower system,
- Nakhon Phanom Tower system,
- Nakhon Ratchasima Tower system.
- Petchaboon Tower system,
- Nan Tower system,
- Phare Tower system,
- Loei Tower system,
- Buriram Tower system,
- Roi Et Tower system,
- Surin Tower system,
- Chumporn Tower system,
- Trat Tower system,

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- Mae Hong Son Tower system,
- Lampang Tower system,
- Sukhothai Tower system,
- Tak Tower system,
- Mae Sod Tower system,
- Ranong Tower system,
- Trang Tower system,
- Pattani Tower system, and
- Narathiwat Tower system.

(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)

- ARCH18: The Tenderer shall propose and detail the system best suited for the CMA LTS. [E]
(The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.)
- ARCH19: The Tenderer shall propose and detail the system best suited for the HTY LTS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]
- ARCH20: The Tenderer shall propose and detail the system best suited for the PUT LTS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]
- ARCH21: The Tenderer shall propose and detail the system best suited for the UDN RTS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]
- ARCH22: The Tenderer shall propose and detail the system best suited for the SMU RTS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]

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ARCH23: The Tenderer shall propose and detail the system best suited for the NST RTS. (The detail should include, at minimum, a diagram showing connections among all components such as servers components, network components, end system components, inputs, outputs, etc.) [E]

2 The Level of Contingency and Backup Submittal

- COBA01: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for NAS MOPS is capable of. [E]
- COBA02: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for NAS CON/TRA is capable of. [E]
- COBA03: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for NAS IBS is capable of. [E]
- COBA04: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for APP IBS is capable of. [E]
- COBA05: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for CMA APP MOPS is capable of. [E]
- COBA06: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for CMA APP CON/TRA is capable of. [E]
- COBA07: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for HTY APP MOPS is capable of. [E]
- COBA08: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for HTY APP CON/TRA is capable of. [E]
- COBA09: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for PUT APP MOPS is capable of. [E]

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COBA10:	The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for PUT APP CON/TRA is capable of.	[E]
COBA11:	The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for PSL APP MOPS is capable of.	[E]
COBA12:	The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for PSL APP CON/TRA is capable of.	[E]
COBA13:	The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for HHN APP MOPS is capable of.	[E]
COBA14:	The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for HHN APP CON/TRA is capable of.	[E]
COBA15:	The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for the following towers are capable of: <ul style="list-style-type: none"> • Korat Tower system, • Takhli Tower system, • U-tapao Tower system, and • Kampangsan Tower system. 	[E]
COBA16:	The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for the following towers are capable of: <ul style="list-style-type: none"> • Phitsanulok Tower system, • Hua Hin Tower system, • Khon Kaen Tower system, • Chiang Rai Tower system, • Ubon Ratchathani Tower system, • Krabi Tower system, • Surat Thani Tower system, • Sakon Nakhon Tower system, • Nakhon Phanom Tower system, • Nakhon Ratchasima Tower system. • Petchaboon Tower system, • Nan Tower system, • Phare Tower system, 	[E]

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- Loei Tower system,
- Buriram Tower system,
- Roi Et Tower system,
- Surin Tower system,
- Chumporn Tower system,
- Trat Tower system,
- Mae Hong Son Tower system,
- Lampang Tower system,
- Sukhothai Tower system,
- Tak Tower system,
- Mae Sod Tower system,
- Ranong Tower system,
- Trang Tower system,
- Pattani Tower system, and
- Narathiwat Tower system.

- COBA17: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for the CMA LTS is capable of. [E]
- COBA18: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for the HTY LTS is capable of. [E]
- COBA19: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for the PUT LTS is capable of. [E]
- COBA20: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for the UDN RTS is capable of. [E]
- COBA21: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for the SMU RTS is capable of. [E]
- COBA22: The Tenderer shall propose and detail all the contingency and backup capabilities levels that the system best suited for the NST RTS is capable of. [E]

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3 Intersystem Connection Submittal

- INCO01: The Tenderer shall propose and detail the mechanism to provide data integrity and security against unauthorized access, intrusion and malicious computer attacks. [E]
- INCO02: The Tenderer shall propose and detail the list of external system interface of system best suited for NAS MOPS which shall include, at minimum, communication protocol, dimension of external system, and numbers of channel of each external interface. [E]
- INCO03: The Tenderer shall propose and detail the list of external system interface of system best suited for NAS CON/TRA which shall include, at minimum, communication protocol, dimension of external system, and numbers of channel of each external interface. [E]
- INCO04: The Tenderer shall propose and detail the list of external system interface of system best suited for NAS IBS which shall include, at minimum, communication protocol, dimension of external system, and numbers of channel of each external interface. [E]
- INCO05: The Tenderer shall propose and detail the NAS MOPS – AMHS information exchange including all necessary standards documents and ICDs [E]
- INCO06: The Tenderer shall propose and detail the NAS MOPS – CIFDPS information exchange including all necessary standards documents and ICDs. [E]
- INCO07: The Tenderer shall propose and detail the NAS MOPS – AGDL System information exchange including all necessary standards documents and ICDs. [E]
- INCO08: The Tenderer shall propose and detail the NAS MOPS – Surveillance Systems information exchange including all necessary standards documents and ICDs. [E]
- INCO09: The Tenderer shall propose and detail the NAS MOPS – Adjacent ACC ATM Systems information exchange including all necessary standards documents and ICDs. [E]
- INCO10: The Tenderer shall propose and detail the NAS MOPS –RTAFM information [E]

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exchange including all necessary standards documents and ICDs.

- INCO11: The Tenderer shall propose and detail the NAS MOPS –MET System information exchange including all necessary standards documents and ICDs. [E]
- INCO12: The Tenderer shall propose and detail the NAS MOPS –CCMS information exchange including all necessary standards documents and ICDs. [E]
- INCO13: The Tenderer shall propose and detail the NAS MOPS –Other System information exchange including all necessary standards documents and ICDs. [E]
- INCO14: The Tenderer shall propose and detail the NAS MOPS – any other internal systems information exchange including all necessary standards documents and ICDs. [E]
- INCO15: The Tenderer shall propose and detail the list of external system interface of system best suited for all APP MOPS which shall include, at minimum, communication protocol, dimension of external system, and numbers of channel of each external interface. [E]
- INCO16: The Tenderer shall propose and detail the list of external system interface of system best suited for all APP CON/TRA which shall include, at minimum, communication protocol, dimension of external system, and numbers of channel of each external interface. [E]
- INCO17: The Tenderer shall propose and detail the list of external system interface of system best suited for APP IBS which shall include, at minimum, communication protocol, dimension of external system, and numbers of channel of each external interface. [E]
- INCO18: The Tenderer shall propose and detail the APPS – AGDL System information exchange including all necessary standards documents and ICDs. [E]
- INCO19: The Tenderer shall propose and detail the APPS –MET System information exchange including all necessary standards documents and ICDs. [E]
- INCO20: The Tenderer shall propose and detail the APPS –CCMS information exchange including all necessary standards documents and ICDs. [E]
- INCO21: The Tenderer shall propose and detail the APPS –Other System information [E]

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exchange including all necessary standards documents and ICDs.

- INCO22: The Tenderer shall propose and detail the APPS – any other internal systems information exchange including all necessary standards documents and ICDs. [E]
- INCO23: The Tenderer shall propose and detail the list of external system interface of system best suited for all Tower Systems which shall include, at minimum, communication protocol, dimension of external system, and numbers of channel of each external interface. [E]
- INCO24: The Tenderer shall propose and detail the Tower System – AGDL System information exchange including all necessary standards documents and ICDs. [E]
- INCO25: The Tenderer shall propose and detail the Tower System – Airport Surveillance Systems information exchange for Tower System Level III including all necessary standards documents and ICDs. [E]
- INCO26: The Tenderer shall propose and detail the Tower System – CATIS System information exchange including all necessary standards documents and ICDs. [E]
- INCO27: The Tenderer shall propose and detail the Tower System – CCMS information exchange including all necessary standards documents and ICDs. [E]
- INCO28: The Tenderer shall propose and detail the Tower System – Other System information exchange including all necessary standards documents and ICDs. [E]
- INCO29: The Tenderer shall propose and detail the Tower System – any other internal systems information exchange including all necessary standards documents and ICDs. [E]

4 Operator Roles and Workstations Submittal

- ORWO01: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for EC Operator [E]

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Role.

- ORWO02: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for PC Operator Role. [E]
- ORWO03: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for AMAN Operator Role. [E]
- ORWO04: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for TACTSUP Operator Role. [E]
- ORWO05: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for CMAC Operator Role. [E]
- ORWO06: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for OPSUP Operator Role. [E]
- ORWO07: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for FISL Operator Role. [E]
- ORWO08: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for TECHSUP Operator Role. [E]
- ORWO09: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for FMM Operator Role. [E]
- ORWO10: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for FMC Operator Role. [E]

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- ORWO11: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for FDO Operator Role. [E]
- ORWO12: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for DSO Operator Role. [E]
- ORWO13: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for ADF Operator Role. [E]
- ORWO14: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for MTN Operator Role. [E]
- ORWO15: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for TRN Operator Role. [E]
- ORWO16: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for PSP Operator Role. [E]
- ORWO17: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for TMC Operator Role. [E]
- ORWO18: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for GND Operator Role. [E]
- ORWO19: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for LCL Operator Role. [E]
- ORWO20: The Tenderer shall propose and detail the software [E]

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characteristics/functions/capabilities of workstation best suited for COR Operator Role.

- ORWO21: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for CDC Operator Role. [E]
- ORWO22: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for T-TACTSUP Operator Role. [E]
- ORWO23: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for DMAN Operator Role. [E]
- ORWO24: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for T-EO Operator Role. [E]
- ORWO25: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for T-FDO Operator Role. [E]
- ORWO26: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for T-DSO Operator Role. [E]
- ORWO27: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for MIL Operator Role. [E]
- ORWO28: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for FAO Operator Role. [E]
- ORWO29: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for BAO Operator Role. [E]

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Role.

- ORWO30: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for ARO Operator Role. [E]
- ORWO31: The Tenderer shall propose and detail the software characteristics/functions/capabilities of workstation best suited for T-MTN Operator Role. [E]

5 Site Information and Network Infrastructure Submittal

5.1 Network Infrastructure

- SINI01: The Tenderer shall propose and detail the network configuration for all systems at Tung Mahamek Site. [E]
- SINI02: The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at Tung Mahamek Site. [D]
- SINI03: The Tenderer shall propose and detail the list of supplies of network equipments and related components for Tung Mahamek Site. [E]
- SINI04: The Tenderer shall propose and detail the network configuration for all systems at Chiang Mai Site. [E]
- SINI05: The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at Chiang Mai Site. [D]
- SINI06: The Tenderer shall propose and detail the list of supplies of network equipments and related components for Chiang Mai Site. [E]
- SINI07: The Tenderer shall propose and detail the network configuration for all systems at [E]

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Hat Yai Site.		
SINI08:	The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at Hat Yai Site.	[D]
SINI09:	The Tenderer shall propose and detail the list of supplies of network equipments and related components for Hat Yai Site.	[E]
SINI10:	The Tenderer shall propose and detail the network configuration for all systems at Phuket Site.	[E]
SINI11:	The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at Phuket Site.	[D]
SINI12:	The Tenderer shall propose and detail the list of supplies of network equipments and related components for Phuket Site.	[E]
SINI13:	The Tenderer shall propose and detail the network configuration for all systems at Phitsanulok Site.	[E]
SINI14:	The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at Phitsanulok Site.	[D]
SINI15:	The Tenderer shall propose and detail the list of supplies of network equipments and related components for Phitsanulok Site.	[E]
SINI16:	The Tenderer shall propose and detail the network configuration for all systems at Hua Hin Site.	[E]
SINI17:	The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at Hua Hin Site.	[D]
SINI18:	The Tenderer shall propose and detail the list of supplies of network equipments and related components for Hua Hin Site.	[E]
SINI19:	The Tenderer shall propose and detail the network configuration for all systems at Ubon Ratchathani Site.	[E]
SINI20:	The Tenderer shall provide product description/Technical Characteristics of	[D]

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network equipments and related components at Ubon Ratchathani Site.

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| SINI21: | The Tenderer shall propose and detail the list of supplies of network equipments and related components for Ubon Ratchathani Site. | [E] |
| SINI22: | The Tenderer shall propose and detail the network configuration for all systems at Udon Thani Site. | [E] |
| SINI23: | The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at Udon Thani Site. | [D] |
| SINI24: | The Tenderer shall propose and detail the list of supplies of network equipments and related components for Udon Thani Site. | [E] |
| SINI25: | The Tenderer shall propose and detail the network configuration for all systems at Surat Thani Site. | [E] |
| SINI26: | The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at Surat Thani Site. | [D] |
| SINI27: | The Tenderer shall propose and detail the list of supplies of network equipments and related components for Surat Thani Site. | [E] |
| SINI28: | The Tenderer shall propose and detail the network configuration for all systems at all Level-I Category Tower Site. | [E] |
| SINI29: | The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at all Level-I Category Tower Site. | [D] |
| SINI30: | The Tenderer shall propose and detail the list of supplies of network equipments and related components for all Level-I Category Tower Site. | [E] |
| SINI31: | The Tenderer shall propose and detail the network configuration for all systems at all Level-II Category Tower Sites. | [E] |
| SINI32: | The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at all Level-II Category Tower Sites. | [D] |
| SINI33: | The Tenderer shall propose and detail the list of supplies of network equipments | [E] |

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and related components for all Level-II Category Tower Sites.

SINI34:	The Tenderer shall propose and detail the network configuration for all systems at all Level-III Category Tower Sites.	[E]
SINI35:	The Tenderer shall provide product description/Technical Characteristics of network equipments and related components at all Level-III Category Tower Sites.	[D]
SINI36:	The Tenderer shall propose and detail the list of supplies of network equipments and related components for all Level-III Category Tower Sites.	[E]
SINI37:	The Tenderer shall propose and detail the network configuration for all systems for all Optional workstations at all sites.	[E]
SINI38:	The Tenderer shall provide product description/Technical Characteristics of network equipments and related components for all Optional workstations at all sites.	[D]
SINI39:	The Tenderer shall propose and detail the list of supplies of network equipments and related components for all Optional workstations at all sites.	[E]
SINI40:	The Tenderer shall propose and detail the network configuration for support of all Future Expansion workstations at all sites	[D]

6 The Planned Workstation Quantities Submittal

PLQN01:	The Tenderer shall propose the list of supplies for NAS.	[E]
PLQN02:	The Tenderer shall propose the list of supplies for Air Defense Units.	[E]
PLQN03:	The Tenderer shall propose the list of supplies for CMA APP System.	[E]
PLQN04:	The Tenderer shall propose the list of supplies for HTY APP System.	[E]
PLQN05:	The Tenderer shall propose the list of supplies for PUT APP System.	[E]

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PLQN06:	The Tenderer shall propose the list of supplies for PSL APP System.	[E]
PLQN07:	The Tenderer shall propose the list of supplies for HHN APP System.	[E]
PLQN08:	The Tenderer shall propose the list of supplies for all Level-I Category Tower Systems.	[E]
PLQN09:	The Tenderer shall propose the list of supplies for all Level-II Category Tower Systems.	[E]
PLQN10:	The Tenderer shall propose the list of supplies for all Level-III Category Tower Systems.	[E]
PLQN11:	The Tenderer shall propose the list of supplies for all Optional workstations for NAS.	[E]
PLQN12:	The Tenderer shall propose the list of supplies for all Optional workstations for all Level-II Category Tower Systems.	[D]
PLQN13:	The Tenderer shall propose the list of supplies for all Optional workstations for all Level-III Category Tower Systems.	[D]
PLQN14:	The Tenderer shall propose the list of supplies for all Software for Optional workstations for NAS.	[D]
PLQN15:	The Tenderer shall propose the list of supplies for all Software for Optional workstations for all Level-II Category Tower Systems.	[D]
PLQN16:	The Tenderer shall propose the list of supplies for all Software for Optional workstations for all Level-III Category Tower Systems.	[D]
PLQN17:	The Tenderer shall propose the list of supplies for all Network Equipment for Optional workstations for NAS.	[D]
PLQN18:	The Tenderer shall propose the list of supplies for all Network Equipment for Optional workstations for all Level-II Category Tower Systems.	[D]
PLQN19:	The Tenderer shall propose the list of supplies for all Network Equipment for	[D]

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Optional workstations for all Level-III Category Tower Systems.

PLQN20:	The Tenderer shall propose the future expansion capabilities of NAS.	[E]
PLQN21:	The Tenderer shall propose the future expansion capabilities of CMA APP System.	[E]
PLQN22:	The Tenderer shall propose the future expansion capabilities of HTY APP System.	[E]
PLQN23:	The Tenderer shall propose the future expansion capabilities of PUT APP System.	[E]
PLQN24:	The Tenderer shall propose the future expansion capabilities of PSL APP System.	[E]
PLQN25:	The Tenderer shall propose the future expansion capabilities of HHN APP System.	[E]
PLQN26:	The Tenderer shall propose the future expansion capabilities of NAS IBS.	[D]
PLQN27:	The Tenderer shall propose the future expansion capabilities of APP IBS.	[D]

7 The Voice Communication and Control System (VCCS) Submittal

VCCS01:	The Tenderer shall propose and detail the VCCS configuration of the MOPS, Fallback and CON/TRA at Tung Mahamek site, Chiang Mai site, Hat Yai site, Phuket site, Phitsanulok site, and Hua Hin site.	[E]
VCCS02:	The Tenderer shall propose and detail the configuration of radio and telephone lines connection to all VCCS (MOPS, Fallback and CON/TRA) at Tung Mahamek site, Chiang Mai site, Hat Yai site, Phuket site, Phitsanulok site, and Hua Hin site.	[E]
VCCS03:	The Tenderer shall propose and detail an input control principle which manages the radio and telephone lines of VCCS for the MOPS, Fallback and CON/TRA according to each mode of operation.	[E]
VCCS04:	The Tenderer shall propose and detail the configuration of the VCCS Workstation facilities.	[E]

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VCCS05:	The Tenderer shall provide product description of the proposed TED panel detailing functionalities, capabilities and benefits.	[E]
VCCS06:	The Tenderer shall propose and detail the capability of RX and TX buttons setting for each remote radio station on the TED panel.	[E]
VCCS07:	The Tenderer shall propose and detail the status indication of telephone lines on the TED panel.	[E]
VCCS08:	The Tenderer shall provide product description of the proposed headset/handset detailing functionalities, capabilities and benefits.	[D]
VCCS09:	The Tenderer shall provide product description of the proposed loudspeaker for ground-ground and air-ground communication detailing functionalities, capabilities and benefits.	[D]
VCCS10:	The Tenderer shall provide product description of the proposed foot switch detailing functionalities, capabilities and benefits.	[D]
VCCS11:	The Tenderer shall provide product description of the proposed slave clock detailing functionalities, capabilities and benefits.	[E]
VCCS12:	The Tenderer shall propose and detail the receiver muting capability of radio line interface module (RLIM) when the transmitter is transmitting.	[E]
VCCS13:	The Tenderer shall propose and detail the capability of VCCS Workstation facilities for radio frequency monitoring.	[E]
VCCS14:	The Tenderer shall propose and detail the delay time adjustment of the RLIM (transmit, receive and PTT signal.)	[E]
VCCS15:	The Tenderer shall propose and detail the audio level adjustment of the RLIM both in transmitting and receiving directions.	[D]
VCCS16:	The Tenderer shall propose and detail the RLIM capability to interface using digital format.	[E]
VCCS17:	The Tenderer shall propose a maximum number of radio lines per each RLIM.	[E]

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VCCS18:	The Tenderer shall propose the main and standby transmitter and receiver channeling throughout.	[E]
VCCS19:	The Tenderer shall propose and detail both quantity and type of telephone line interface modules (TLIM).	[E]
VCCS20:	The Tenderer shall propose a maximum number of telephone lines per TLIM.	[E]
VCCS21:	The Tenderer shall propose and detail the audio level adjustment capability of the TLIM both in transmitting and receiving directions.	[D]
VCCS22:	The Tenderer shall provide product description of the proposed Technical Control Unit (TCU) detailing functionalities, capabilities and benefits.	[E]
VCCS23:	The Tenderer shall propose and detail the authentication method when the user logs into the TCU.	[D]
VCCS24:	The Tenderer shall propose and detail the methodology of online reconfiguration from the TCU.	[D]
VCCS25:	The Tenderer shall propose and detail all alert/alarm indication methods at TCU, when VCCS malfunction is detected.	[D]
VCCS26:	The Tenderer shall propose and detail the capability to select/deselect the receivers and transmitters (main and standby channels.)	[D]
VCCS27:	The Tenderer shall propose and detail the status indication of radio lines on the TED panel.	[E]
VCCS28:	The Tenderer shall propose and detail the capability and characteristic of the interlock between radio transmitter main and standby channels.	[E]
VCCS29:	The Tenderer shall propose and detail the capability of the multi-lines radio transmission/reception at the same time.	[E]
VCCS30:	The Tenderer shall propose and detail the capability and characteristic of the radio function when frequencies in TX or RX modes and the call are being received at the same time.	[E]

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VCCS31: The Tenderer shall propose and detail the capability of audio level control of loudspeaker.		[D]
VCCS32: The Tenderer shall propose and detail the capability of audio level control of headset/handset.		[D]
VCCS33: The Tenderer shall propose and detail the Receiver Voting function (Best Signal Selection).		[E]
VCCS34: The Tenderer shall propose the maximum number of receivers used by Receiver Voting function.		[E]
VCCS35: The Tenderer shall propose and detail the capability and characteristic of the automatic selection of transmitter.		[D]
VCCS36: The Tenderer shall propose and detail the interfacing configuration of local radio stations and remote radio stations with all VCCS (MOPS, Fallback and CON/TRA).		[E]
VCCS37: The Tenderer shall propose and detail both quantity and characteristic of the provided voice multiplexers which interface the local radio stations and all VCCS (MOPS, Fallback and CON/TRA) at BACC/BAPC via exiting AEROTHAI core optical fiber facilities.		[E]
VCCS38: The Tenderer shall propose and detail the alarm characteristic of the provided voice multiplexers for BACC/BAPC.		[E]
VCCS39: The Tenderer shall propose and detail the interfacing system, including configuration, quantity, characteristic, etc., which interfaces the local radio stations and all VCCS (MOPS, Fallback and CON/TRA) at CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.		[E]
VCCS40: The Tenderer shall propose and detail the automatic/manual media selection function capability to use one of three communication media (Digital Data Network (DDN), satellite and frame relay) at a time.		[E]
VCCS41: The Tenderer shall propose and detail the types of telephone calls that can be made by telephone buttons.		[D]

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VCCS42:	The Tenderer shall propose and detail the connection/disconnection operation principle capability of the DA and IA call.	[D]
VCCS43:	The Tenderer shall propose and detail the connection/disconnection operation signaling tones characteristic of the DA and IA call.	[E]
VCCS44:	The Tenderer shall propose and detail the telephone function capability (such as Hold, Conference, Transfer etc.) and buttons configuration of the DA and IA.	[D]
VCCS45:	The Tenderer shall propose and detail the Intercom function capability of the system.	[E]
VCCS46:	The Tenderer shall propose and detail the voice page function capability of the system.	[E]
VCCS47:	The Tenderer shall propose and detail the capability and characteristic of the short time (or term) recording function.	[E]
VCCS48:	The Tenderer shall propose and detail the capability and characteristic of ambient noise recording facility at each VCCS workstation facility.	[E]
VCCS49:	The Tenderer shall propose and detail the capability and configuration of the GPS master clock.	[E]
VCCS50:	The Tenderer shall propose and detail the synchronization capability of the GPS master clock with the voice recorder or other master clocks.	[E]
VCCS51:	The Tenderer shall propose and detail the configuration and lay out of the slave clocks on console.	[D]
VCCS52:	The Tenderer shall propose and detail the AC/DC input power capability and configuration of the central racks.	[E]
VCCS53:	The Tenderer shall propose and detail the AC/DC input power capability and configuration of other equipments.	[E]
VCCS54:	The Tenderer shall propose and detail the principle operation between AC power supply system and DC power supply system of the central racks and other	[D]

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equipment.

- VCCS55: The Tenderer shall propose and detail the interfacing configuration between the VCCS central racks and the main distribution frame (MDF). [E]
- VCCS56: The Tenderer shall propose and detail the configuration and performance of the lightning protection which is equipped for all radio and telephone lines at the MDF. [E]
- VCCS57: The Tenderer shall propose and detail the inter-connection configuration between VCCS workstation facilities and the VCCS central racks. [E]
- VCCS58: The Tenderer shall propose and detail the Position Record configuration of the VCCS and the proposed Digital Voice Recorder & Replay System (DVR). [E]
- VCCS59: The Tenderer shall propose and detail the Lines Record configuration of the VCCS and the proposed DVR. [E]
- VCCS60: The Tenderer shall propose and detail the methodology to monitor voice input/output of any interfaces of both telephone and radio communications. [D]
- VCCS61: The Tenderer shall propose and detail the capability and performance of the fallback VCCS. [E]
- VCCS62: The Tenderer shall propose and detail the VCCS workstations facilities configuration and inter-connection between main and fallback VCCS. [E]
- VCCS63: The Tenderer shall propose and detail the radio and telephone lines configuration and inter-connection between main and fallback VCCS. [E]
- VCCS64: The Tenderer shall propose and detail the AC/DC input power capability of the Fallback VCCS. [E]
- VCCS65: The Tenderer shall propose and detail the capability and performance of the CON/TRA VCCS. [E]
- VCCS66: The Tenderer shall propose and detail the AC/DC input power capability of the CON/TRA VCCS. [E]

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VCCS67:	The Tenderer shall propose and detail the VCCS workstations facilities configuration of CON/TRA VCCS.	[E]
VCCS68:	The Tenderer shall propose and detail the list of supplies of VCCS and VCCS-related equipments for MOPS, Fallback and CON/TRA at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VCCS69:	The Tenderer shall propose and detail the quantity of 2-Wire telephone set, 2-Wire Voice Call, PSTN and PABX TLIM for MOPS, Fallback and CON/TRA VCCS at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VCCS70:	The Tenderer shall propose and detail the quantity of 4-Wire RLIM for MOPS, Fallback and CON/TRA VCCS at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VCCS71:	The Tenderer shall propose and detail the quantity of E1 RLIM for MOPS, Fallback and CON/TRA VCCS at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VCCS72:	The Tenderer shall propose and detail the quantity of VoIP RLIM for MOPS, Fallback and CON/TRA VCCS at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VCCS73:	The Tenderer shall propose and detail the quantity of headset and handset for MOPS and CON/TRA VCCS at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VCCS74:	The Tenderer shall propose and detail the modification of the existing headsets.	[E]
VCCS75:	The Tenderer shall propose and detail the initial spare cards or modules against the total quantity of cards or modules of MOPS VCCS, Fallback VCCS and CON/TRA VCCS at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VCCS76:	The Tenderer shall propose and detail the technical manual, which includes, at minimum complete installation, operation and maintenance instructions.	[E]

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VCCS77:	The Tenderer shall propose the quantity of technical manual both hard and soft copy for all VCCS at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[D]
VRS01:	The Tenderer shall propose and detail the capacity of duplex analogue audio channels to be recorded simultaneously of the recorder units at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VRS02:	The Tenderer shall propose and detail the synchronization mechanism between DVR's clock and VCCS's GPS master clock.	[E]
VRS03:	The Tenderer shall propose the maximum capacity of the channels expansion of each recorder units at BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC and detail the conditions for the proposed capacity (for example number of empty slot channels, available space in rack, maximum available power supply, etc.).	[E]
VRS04:	The Tenderer shall provide product description of the proposed recorder units detailing functionalities, capabilities and benefits.	[D]
VRS05:	The Tenderer shall propose and detail the recording during silent period capability of the recorder units.	[D]
VRS06:	The Tenderer shall propose and detail the capability and performance of the short-term media type of the recorder units.	[E]
VRS07:	The Tenderer shall propose and detail the capability and performance of simultaneous recording and replay of the recorder units. (such as maximum time used for query data records in the short-term media, etc.)	[D]
VRS08:	The Tenderer shall propose and detail the configuration, type and performance of the media used for short-term media recording in the recorder units.	[D]
VRS09:	The Tenderer shall propose and detail the simultaneously recording capability between archival media type and short-term media type of the recorder units.	[E]
VRS10:	The Tenderer shall propose and detail the recording capacity (in term of hours of	[E]

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recording) for the archival media of the recorder units without necessitating any operator involvement.

VRS11:	The Tenderer shall detail the simultaneous retrieval and recording capability of the recorder units.	[D]
VRS12:	The Tenderer shall propose and detail the recorded content such as time stamps, additional data etc. of the recorder units.	[E]
VRS13:	The Tenderer shall propose and detail the capability, capacity and performance of archival media type of the recorder units.	[E]
VRS14:	The Tenderer shall propose and detail the capability and configuration of the inter-connection between the replay unit and the recorder unit.	[E]
VRS15:	The Tenderer shall propose the number of replay units for BACC/BAPC, CMA APC, HTY APC, PUT APC, PLS APC and HHN APC.	[E]
VRS16:	The Tenderer shall provide product description of the replay units detailing functionalities, capabilities and benefits.	[D]
VRS17:	The Tenderer shall propose the maximum number of channels for replaying simultaneous duplex channels of the replay units.	[E]
VRS18:	The Tenderer shall propose the maximum number of simultaneous duplex channels for live monitoring of the replay units.	[D]
VRS19:	The Tenderer shall propose and detail the capability to duplicate recordings to the standard analogue recording equipment of the replay units.	[D]
VRS20:	The Tenderer shall propose and detail the other type of control to play the recording media of the replay units.	[D]
VRS21:	The Tenderer shall propose and detail the synchronization methodology between the corresponding output from the Replay feature (REP) and other relevant recordings capability of the replay units.	[D]
VRS22:	The Tenderer shall propose and detail the archival media replay capability at the	[E]

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dedicated replay units.

- VRS23: The Tenderer shall propose and detail the capability of the replay units to select any recording from recorder units. [E]
- VRS24: The Tenderer shall propose and detail the variable playback speed and pitch interval controller capability of the replay units. [E]
- VRS25: The Tenderer shall provide product description of the DVR supervisor units detailing functionalities, capabilities and benefits. [D]
- VRS26: The Tenderer shall propose and detail the operations and parameter settings capability of the DVR supervisor units. [E]
- VRS27: The Tenderer shall propose and detail all alert/alarm indication methods of the DVR supervisor units. [E]
- VRS28: The Tenderer shall propose and detail the capability and configuration of AC power supply of the recorder unit and the DVR supervisor unit. [E]
- VRS29: The Tenderer shall propose and detail the configuration of the Fallback and CON/TRA DVR. [E]

8 System Functionalities Submittal

- SF01: The Tenderer shall provide the breakdown diagram of all system functionalities and system capabilities of the proposed following systems: NAS, NAS IBS, APP Systems, APP IBS, Level-III LTS, Level-III RTS, Level-II LTS, Level-II RTS and Level-I RTS. [D]

8.1 Surveillance Data Processing

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SDP01:	The Tenderer shall provide product description of the proposed system detailing MSDP functionalities, capabilities and benefits.	[D]
SDP02:	The Tenderer shall provide product description of the proposed system detailing FSDP functionalities, capabilities and benefits.	[D]
SDP03:	The Tenderer shall propose and detail the surveillance data processing algorithms used by MSDP and FSDP.	[D]
SDP04:	The Tenderer shall provide product description of the proposed system detailing Surveillance Direct Access functionalities, capabilities and benefits.	[D]
SDP05:	The Tenderer shall provide product description of the proposed system detailing Mono-RADAR processing functionalities, capabilities and benefits.	[D]
SDP06:	The Tenderer shall propose and detail type of RADAR, RADAR data format supported by Mono-RADAR processing of both MSDP and FSDP of the system as follow: <ul style="list-style-type: none">• NAS MOPS• NAS CON/TRA• NAS IBS• APP MOPS• APP CON/TRA• APP IBS	[D]
SDP07:	The Tenderer shall propose and detail the methodology and parameters used to define the Mono-RADAR processing.	[D]
SDP08:	The Tenderer shall propose and detail methodology to display Mono-RADAR information to the ATC.	[D]
SDP09:	The Tenderer shall provide product description of the proposed system detailing Multi-RADAR processing functionalities, capabilities and benefits.	[D]
SDP10:	The Tenderer shall propose and detail type of RADAR, RADAR data format, maximum number of RADAR input and maximum number of RADAR in an overlap area that are supported by Multi-RADAR processing of both MSDP and	[D]

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FSDP of the following systems:

- NAS MOPS
- NAS CON/TRA
- NAS IBS
- APP MOPS
- APP CON/TRA
- APP IBS

- SDP11: The Tenderer shall propose and detail the maximum number of simultaneous Multi-RADAR track that are supported by Multi-RADAR processing of both MSDP and FSDP of the following systems: [D]
- NAS MOPS
 - NAS CON/TRA
 - NAS IBS
 - APP MOPS
 - APP CON/TRA
 - APP IBS
- SDP12: The Tenderer shall propose and detail the methodology and parameters used to configure the Multi-RADAR processing. [D]
- SDP13: The Tenderer shall propose and detail methodology to display Multi-RADAR information to the ATC. [D]
- SDP14: The Tenderer shall provide product description of the proposed system detailing ADS-B processing functionalities, capabilities and benefits. [D]
- SDP15: The Tenderer shall propose and detail the methodology of ADS-B validation techniques that are used to improve ADS-B track position and altitude. [D]
- SDP16: The Tenderer shall propose and detail the ADS-B data format, the maximum number of ADS-B ground station that are supported by ADS-B processing of both MSDP and FSDP of the following systems: [D]
- NAS MOPS
 - NAS CON/TRA
 - NAS IBS

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<ul style="list-style-type: none">• APP MOPS• APP CON/TRA• APP IBS		
SDP17:	The Tenderer shall propose and detail the maximum number of simultaneous ADS-B track supported by ADS-B processing of both MSDP and FSDP of the following systems: <ul style="list-style-type: none">• NAS MOPS• NAS CON/TRA• NAS IBS• APP MOPS• APP CON/TRA• APP IBS	[D]
SDP18:	The Tenderer shall propose and detail the methodology and parameters used to configure the ADS-B processing.	[D]
SDP19:	The Tenderer shall propose and detail methodology to display ADS-B information to the ATC.	[D]
SDP20:	The Tenderer shall provide product description of the proposed system detailing MLAT/WAM processing functionalities, capabilities and benefits.	[D]
SDP21:	The Tenderer shall propose and detail the MLAT/WAM data format, the maximum number of MLAT/WAM data input that are supported by MLAT/WAM processing of both MSDP and FSDP of the following systems: <ul style="list-style-type: none">• NAS MOPS• NAS CON/TRA• NAS IBS• APP MOPS• APP CON/TRA• APP IBS	[D]
SDP22:	The Tenderer shall propose and detail the maximum number of simultaneous MLAT/WAM track that are supported by MLAT/WAM processing of both MSDP and FSDP of the following systems:	[D]

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<ul style="list-style-type: none">• NAS MOPS• NAS CON/TRA• NAS IBS• APP MOPS• APP CON/TRA• APP IBS		
SDP23:	The Tenderer shall propose and detail the methodology and parameters used to configure the MLAT/WAM processing.	[D]
SDP24:	The Tenderer shall propose and detail methodology to display MLAT/WAM information to the ATC.	[D]
SDP25:	The Tenderer shall provide product description of the proposed system detailing Multi-Sensor Fusion processing functionalities, capabilities and benefits.	[D]
SDP26:	The Tenderer shall propose and the maximum number of simultaneous system track that are supported by Multi-Sensor Fusion processing of both MSDP and FSDP of the following systems: <ul style="list-style-type: none">• NAS MOPS• NAS CON/TRA• NAS IBS• APP MOPS• APP CON/TRA• APP IBS	[D]
SDP27:	The Tenderer shall propose and detail the methodology and parameters used to configure the Multi-Sensor Fusion processing.	[D]
SDP28:	The Tenderer shall propose and detail methodology to display Multi-Sensor Fusion information to the ATC.	[D]
SDP29:	The Tenderer shall provide product description of the proposed system detailing weather information processing functionalities, capabilities and benefits.	[D]
SDP30:	The Tenderer shall propose and detail the weather information data format, the maximum number of Weather information data input that are supported by Weather	[D]

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information processing of both MSDP and FSDP of the following systems:

- NAS MOPS
- NAS CON/TRA
- NAS IBS
- APP MOPS
- APP CON/TRA
- APP IBS

- SDP31: The Tenderer shall propose and detail the maximum number of simultaneous Graphic RADAR weather picture that are supported by Weather information processing of both MSDP and FSDP of the system as follow: [D]
- NAS MOPS
 - NAS CON/TRA
 - NAS IBS
 - APP MOPS
 - APP CON/TRA
 - APP IBS
- SDP32: The Tenderer shall propose and detail the methodology and parameters used to configure the Multi-Sensor Fusion processing. [D]
- SDP33: The Tenderer shall propose and detail methodology to display Weather information to the ATC. [D]
- SDP34: The Tenderer shall propose and detail the methodology and capability to manage the redundant surveillance data input of both MSDP and FSDP. [D]
- SDP35: The Tenderer shall propose and detail the methodology and capability to detect the communication problems and/or low quality data. [D]
- SDP36: The Tenderer shall provide product description of the proposed system detailing surveillance data input firewall functionalities, capabilities and benefits. [D]
- SDP37: The Tenderer shall propose and detail methodology to analysis and filter out the incomplete surveillance messages. [D]
- SDP38: The Tenderer shall propose and detail the capability and notification of plot [D]

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overloads protection.

- SDP39: The Tenderer shall propose the maximum number of plots per RADAR, per sector and maximum number of plots per RADAR, per antenna revolution that are used in plot overloads protection. [D]
- SDP40: The Tenderer shall provide product description of the proposed system detailing Surveillance blanking areas functionalities, capabilities and benefits. [D]
- SDP41: The Tenderer shall propose and detail the methodology and parameters used to define the surveillance blanking areas. [D]
- SDP42: The Tenderer shall propose and detail the surveillance blanking areas characteristics and minimum size of surveillance blanking area. [D]
- SDP43: The Tenderer shall propose the maximum number of surveillance blanking area of each surveillance sensor. [D]
- SDP44: The Tenderer shall propose and detail the methodology and parameters used to define the surveillance processing area. [D]
- SDP45: The Tenderer shall propose the maximum size of surveillance processing area. [D]
- SDP46: The Tenderer shall provide product description of the proposed system detailing Barometric Altitude Correction functionalities, capabilities and benefits. [D]
- SDP47: The Tenderer shall propose and detail the methodology and parameters to define the barometric altitude correction. [D]
- SDP48: The Tenderer shall propose the maximum number of QNH area supported by SDP. [D]
- SDP49: The Tenderer shall provide product description of the proposed system detailing Altitude Tracking functionalities, capabilities and benefits. [D]
- SDP50: The Tenderer shall provide product description of the proposed system detailing Stereographic Projection functionalities, capabilities and benefits. [D]
- SDP51: The Tenderer shall provide product description of the proposed system detailing Specific codes functionalities, capabilities and benefits. [D]
- SDP52: The Tenderer shall provide product description of the proposed system detailing [D]

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Test Targets Monitoring functionalities, capabilities and benefits.

SDP53:	The Tenderer shall propose and detail type of test targets monitoring that are supported by SDP.	[D]
SDP54:	The Tenderer shall propose the maximum number of test target monitoring of each RADAR.	[D]
SDP55:	The Tenderer shall propose and detail the methodology and parameters used to define the test targets monitoring.	[D]
SDP56:	The Tenderer shall propose and detail the methodology to notify when the test target position falls out of tolerance.	[D]
SDP57:	The Tenderer shall provide product description of the proposed system detailing RADAR bias estimation functionalities, capabilities and benefits.	[D]
SDP58:	The Tenderer shall propose and detail type of RADAR bias estimation provided to SDP.	[D]
SDP59:	The Tenderer shall propose and detail the methodology and parameters used to define the RADAR bias estimation.	[D]
SDP60:	The Tenderer shall provide product description of the proposed system detailing Track overload protection functionalities, capabilities and benefits.	[D]
SDP61:	The Tenderer shall propose and detail the methodology to notify when the number of system tracks reaches the maximum SDP capacity.	[D]
SDP62:	The Tenderer shall provide product description of the proposed system detailing track cancelation functionalities, capabilities and benefits.	[D]
SDP63:	The Tenderer shall provide product description of the proposed system detailing automatic position report functionalities, capabilities and benefits.	[D]
SDP64:	The Tenderer shall propose and detail the methodology to distribute the “local track”, “Multi-RADAR track”, “ADS-B track”, “MLAT/WAM track” and “system track” and specific data to system of both MSDP and FSDP.	[D]
SDP65:	The Tenderer shall propose and detail the methodology to distribute the system track coupled with associated flight plan to external system.	[D]

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- SDP66: The Tenderer shall propose and detail methodology and criteria to filter the system track that are provided to SDP. [D]
- SDP67: The Tenderer shall provide product description of the proposed system detailing surveillance data output firewall functionalities, capabilities and benefits. [D]
- SDP68: The Tenderer shall provide product description of the proposed system detailing surveillance data analysis tools functionalities, capabilities and benefits. [D]
- SDP69: The Tenderer shall propose and detail the methodology to collect all surveillance data. [D]
- SDP70: The Tenderer shall propose and detail the type of data to be collected by surveillance data analysis tools. [D]
- SDP71: The Tenderer shall propose and detail the capability of reconfiguration the surveillance data input/output of SDP. [D]
- SDP72: The Tenderer shall propose and detail list of provided hardware, accessories, related software, integration procedure, reference documents, essential software tool(s) and training course for reconfiguration the surveillance port. [D]

8.2 Flight Data Processing

- FDP01: The Tenderer shall provide product description of the proposed system detailing FDP functionalities, capabilities and benefits. [D]
- FDP02: The Tenderer shall propose and detail all sources of flight plan that the FDP can handle. [E]
- FDP03: The Tenderer shall propose and detail the validation of flight plan and flight related messages. [E]
- FDP04: The Tenderer shall propose and detail how FDP manage the NEW FPL format 2012. [E]

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FDP05:	The Tenderer shall propose and detail the checking of duplicated flight plans.	[E]
FDP06:	The Tenderer shall propose and detail the unique key of flight plan.	[E]
FDP07:	The Tenderer shall propose and detail the route validation method.	[E]
FDP08:	The Tenderer shall propose and detail the use of field 18 information in FDP.	[E]
FDP09:	The Tenderer shall propose and detail flight plan trajectory prediction calculation.	[E]
FDP10:	The Tenderer shall propose and detail the Aircraft category characteristics used for trajectory calculation.	[E]
FDP11:	The Tenderer shall propose and detail the conceptual flight state model.	[E]
FDP12:	The Tenderer shall propose and detail the flight plan progress and control.	[E]
FDP13:	The Tenderer shall propose and detail the strip-less operation.	[E]
FDP14:	The Tenderer shall propose and detail the flight plan and track association/disassociation.	[E]
FDP15:	The Tenderer shall propose and detail the SSR Code Management.	[E]
FDP16:	The Tenderer shall propose and detail all types of flight clearance that the FDP can support.	[E]
FDP17:	The Tenderer shall propose and detail the creating and defining the airspace structure and sectorization in the FDP database.	[E]
FDP18:	The Tenderer shall propose and detail the flight plan posting rule and condition.	[E]
FDP19:	The Tenderer shall propose and detail how the FDP define and configure FUA.	[E]
FDP20:	The Tenderer shall propose and detail the flight data distribution.	[E]
FDP21:	The Tenderer shall propose and detail the inter-sector coordination.	[E]

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FDP22:	The Tenderer shall propose and detail the AIDC coordination.	[E]
FDP23:	The Tenderer shall propose and detail the flexible role management.	[E]
FDP24:	The Tenderer shall propose and detail the database organization and management in the FDP.	[E]
FDP25:	The Tenderer shall propose and detail the configuration tool for FDP database management.	[E]

8.3	Safety Net	
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SAFE01:	The Tenderer shall provide product description of the proposed system detailing Safety Nets functionalities, capabilities and benefits.	[D]
SAFE02:	The Tenderer shall propose and detail all information used to improve the Safety Nets.	[D]
SAFE03:	The Tenderer shall propose and detail the methodology to enable and/or disable each Safety Nets feature.	[E]
SAFE04:	The Tenderer shall propose and detail the methodology to prevent unauthorized user to enable and/or disable each Safety Nets feature.	[E]
SAFE05:	The Tenderer shall provide product description of the proposed system detailing safety nets data analysis tools functionalities, capabilities and benefits.	[D]
SAFE06:	The Tenderer shall propose and detail the methodology to collect all safety nets data.	[D]
SAFE07:	The Tenderer shall propose and detail the type of data to be collected by safety nets analysis tools.	[D]
SAFE08:	The Tenderer shall provide product description of the proposed system detailing	[D]

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Short Term Conflict Alert (STCA) functionalities, capabilities and benefits.

- SAFE09: The Tenderer shall propose and detail the methodology to detect and notify to the ATC in preventing collision on the potential infringement and actual infringement between aircraft. [D]
- SAFE10: The Tenderer shall propose and detail the separation standards of potential infringement and actual infringement. [D]
- SAFE11: The Tenderer shall propose and detail the methodology and parameters used to define the STCA volume of airspace and separation in their airspace. [D]
- SAFE12: The Tenderer shall propose the maximum number of STCA volumes of airspace that can be defined. [D]
- SAFE13: The Tenderer shall propose the maximum number of STCA volumes of airspace that can be activated simultaneously. [D]
- SAFE14: The Tenderer shall propose and detail the methodology of STCA to process the aircraft's RVSM status whether or not the aircraft are in the RVSM airspace. [D]
- SAFE15: The Tenderer shall propose and detail the methodology to inhibit STCA alerts for the predefined STCA volumes of airspace or individual flights to suppress unnecessary alerts. [D]
- SAFE16: The Tenderer shall provide product description of the proposed system detailing Minimum Safe Altitude Warning (MSAW) functionalities, capabilities and benefits. [D]
- SAFE17: The Tenderer shall propose and detail the methodology to detect and notify to the ATC about increased risk of controlled flight into terrain and/or obstacles. [D]
- SAFE18: The Tenderer shall propose and detail the methodology and parameters used to define terrain, obstacles, MSAW volumes of airspace and look-ahead time in their airspace. [D]
- SAFE19: The Tenderer shall propose and detail how the MSAW operates in case of system degradation (e.g. unavailability of one or more RADAR/ADS-B stations). [D]

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- SAFE20: The Tenderer shall propose the minimum size (resolution) of MSAW volume of airspace supported by MSAW. [D]
- SAFE21: The Tenderer shall propose the maximum number of MSAW volume of airspace that can be defined. [D]
- SAFE22: The Tenderer shall propose the maximum number of MSAW volumes of airspace that can be activated simultaneously. [D]
- SAFE23: The Tenderer shall propose and detail the methodology to inhibit MSAW alerts for predefined MSAW volumes of airspace or individual flights to suppress unnecessary alerts. [D]
- SAFE24: The Tenderer shall provide product description of the proposed system detailing Area Proximity Warning (APW) functionalities, capabilities and benefits. [D]
- SAFE25: The Tenderer shall propose and detail the methodology to detect and notify to the ATC when an aircraft is, or is predicted to be, flying into APW volumes of airspace. [D]
- SAFE26: The Tenderer shall propose and detail the methodology and parameter used to define APW volumes of airspace, activation time and look-ahead time in their airspace both off-line and on-line. [D]
- SAFE27: The Tenderer shall propose and detail how the APW operates in case of system degradation (e.g. unavailability of one or more RADAR/ADS-B stations). [D]
- SAFE28: The Tenderer shall propose the maximum number of APW volumes of airspace that can be defined. [D]
- SAFE29: The Tenderer shall propose the maximum number of APW volumes of airspace that can be activated simultaneously. [D]
- SAFE30: The Tenderer shall propose and detail the methodology to inhibit APW alerts for predefined APW volumes of airspace or individual flights to suppress unnecessary alerts. [D]
- SAFE31: The Tenderer shall provide product description of the proposed system detailing [D]

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Approach Path Monitoring (APM) functionalities, capabilities and benefits.

- SAFE32: The Tenderer shall propose and detail the methodology to detect and notify to the ATC when an aircraft is, or is predicted to be, flying into an Approach Path Monitoring area (APM volume of airspace) with a heading within an adapted range. [D]
- SAFE33: The Tenderer shall propose and detail the methodology and parameters used to define APM volumes of airspace. [D]
- SAFE34: The Tenderer shall propose and detail how the APM perform for both precision and non-precision instrument approaches. [D]
- SAFE35: The Tenderer shall propose and detail the methodology to inhibit APM alerts for the predefined the APM volume of airspace or individual flights to suppress unnecessary alerts. [D]

8.4 Monitoring Aids

- MONA01: The Tenderer shall provide product description of the proposed system detailing monitoring aids (MONA) functionalities, capabilities and benefits. [D]
- MONA02: The Tenderer shall propose and detail all information used to improve the MONA. [D]
- MONA03: The Tenderer shall propose and detail the methodology to enable and/or disable each MONA feature. [D]
- MONA04: The Tenderer shall propose and detail the methodology to prevent unauthorized user to enable and/or disable each MONA feature. [D]
- MONA05: The Tenderer shall provide product description of the proposed system detailing conformance monitoring functionalities, capabilities and benefits. [D]
- MONA06: The Tenderer shall propose and detail all types of trajectory used by MONA. [E]
- MONA07: The Tenderer shall propose and detail all types of conformance monitoring [E]

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provided by MONA.

- MONA08: The Tenderer shall provide product description of the proposed system detailing lateral conformance monitoring functionalities, capabilities and benefits. [D]
- MONA09: The Tenderer shall propose and detail the methodology and parameters used to define the tolerance of lateral conformance monitoring in the airspace and/or routes. [D]
- MONA10: The Tenderer shall propose and detail the methodology to temporarily suspend the lateral conformance monitoring for aircraft notified as under control. [D]
- MONA11: The Tenderer shall provide product description of the proposed system detailing longitudinal conformance monitoring functionalities, capabilities and benefits. [D]
- MONA12: The Tenderer shall propose and detail the methodology and parameters used to define difference of the time estimates on a coordination point of the routes. [D]
- MONA13: The Tenderer shall provide product description of the proposed system detailing vertical conformance monitoring functionalities, capabilities and benefits. [D]
- MONA14: The Tenderer shall propose and detail the methodology and parameters used to define the tolerance of vertical conformance monitoring in the airspace and/or routes. [D]
- MONA15: The Tenderer shall propose and detail the methodology to temporarily suspend the vertical conformance monitoring for aircraft notified as under control. [D]
- MONA16: The Tenderer shall propose and detail the methodology to detect and notify the deviation of the aircraft from their clearances to the ATC. [D]
- MONA17: The Tenderer shall provide product description of the proposed system detailing progress monitoring functionalities, capabilities and benefits. [D]
- MONA18: The Tenderer shall propose and detail the methodology to update trajectory to reflect the actual progress of the aircraft. [D]
- MONA19: The Tenderer shall provide product description of the proposed system detailing automatic reminders functionalities, capabilities and benefits. [D]

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MONA20: The Tenderer shall propose and detail the methodology to remind the routine actions to the ATC. [D]

8.5 Medium-Term Conflict Detection

MTCD01: The Tenderer shall provide product description of the proposed system detailing MTCD functionalities, capabilities and benefits. [D]

MTCD02: The Tenderer shall propose and detail the methodology and parameters used to define the MTCD parameters. [D]

MTCD03: The Tenderer shall propose and detail the methodology of MTCD to detect and notify to the ATC in the probable loss of the required separation between aircraft based on tactical based encounters. [D]

MTCD04: The Tenderer shall propose and detail the methodology of MTCD to detect and notify to the ATC in the probable loss of the required separation between aircraft based on plan based encounters. [D]

MTCD05: The Tenderer shall propose and detail the methodology to detect and notify to the ATC when aircraft penetrating segregated or otherwise restricted airspace. [D]

8.6 Airspace Organization and Management

AOM01: The Tenderer shall provide product description of the proposed system detailing AOM functionalities, capabilities and benefits. [D]

AOM02: The Tenderer shall propose and detail the functions which support airspace organization or airspace structures. [D]

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- AOM03: The Tenderer shall propose and detail the functions which support dynamic and flexible airspace management. [D]
- AOM04: The Tenderer shall propose and detail the functions which support three levels of airspace management (Strategic, Pre-tactical and Tactical). [D]

8.7 Flexible Use of Airspace (FUA) Coordination

- FUA01: The Tenderer shall provide product description of the proposed system detailing FUA functionalities, capabilities and benefits. [D]
- FUA02: The Tenderer shall propose and detail the functions which support the classification of any airspace. [D]
- FUA03: The Tenderer shall propose and detail the functions which support Flexible airspace configuration using traffic flows, airspace restrictions, runway configuration at airports, etc. [D]
- FUA04: The Tenderer shall propose and detail the functions which support usage of Flexible airspace such as the conditions for transfer of the airspace, the periods of availability of the airspace, etc. [D]
- FUA05: The Tenderer shall propose and detail the functions which support on-line redefinition and presentation of sectors including opening and closing. [D]

8.8 Demand and Capacity Balancing

- DCB01: The Tenderer shall provide product description of the proposed system detailing DCB functionalities, capabilities and benefits. [D]

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- DCB02: The Tenderer shall propose and detail the functions which support information to the airspace users for mitigating conflicting needs for airspace and aerodrome capacity. [D]
- DCB03: The Tenderer shall propose and detail the functions which support information to the airspace user in the three stages (Strategic, Pre-tactical and Tactical). [D]

8.9 Air Traffic Flow Management

- ATFM01: The Tenderer shall provide product description of the proposed system detailing ATFM functionalities, capabilities and benefits. [D]
- ATFM02: The Tenderer shall propose and detail the functions which support information where demand exceeds the sector capacity. [D]
- ATFM03: The Tenderer shall propose the range of the look-ahead time of predicted traffic. [D]
- ATFM04: The Tenderer shall propose and detail the functions which support information for each sector within the selected look ahead time such as Number of flights per hour (Transit, ARR and DEP) and Traffic Load Window. [D]
- ATFM05: The Tenderer shall propose and detail the functions which support information the Pre-tactical activities (research, planning and coordination). [D]
- ATFM06: The Tenderer shall propose the number of day that the function can provide Pre-tactical activities information. [D]
- ATFM07: The Tenderer shall propose and detail the functions which support sector capacity configuration in various conditions, e.g. weather, staffing and equipment serviceability. [D]

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8.10 Traffic Synchronization

TS01: The Tenderer shall provide product description of the proposed system detailing TS functionalities, capabilities and benefits. [D]

8.11 Arrival Manager

AMAN01: The Tenderer shall provide product description of the proposed system detailing AMAN functionalities, capabilities and benefits. [D]

AMAN02: The Tenderer shall propose and detail the capability of the provide functions to support the sequencing in order to advices controllers enhance the orderly flow of traffic based on the first-come first-served principle. [D]

AMAN03: The Tenderer shall propose and detail the capability of the provide functions to support the scheduling in order to advices controllers enhance the orderly flow of traffic based on the first-come first-served principle. [D]

AMAN04: The Tenderer shall propose and detail the capability of the provide functions to support optimisation (minimum overall average delay) of sequencing and scheduling. [D]

AMAN05: The Tenderer shall propose and detail the methodology of sequencing, scheduling and optimization calculations [D]

AMAN06: The Tenderer shall propose and detail the functions which support minimum as following; [D]

- sequencing in the multi-airport, multi-runway configuration
- maximum number of aircraft at each holding locations
- manual adjustment of the flow rate
- manual change of the runway in use/closure
- insert a flight with aircraft identification into the sequence
- removal reserved arrival slots in the event of changing aerodrome

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conditions.

- AMAN07: The Tenderer shall propose and detail the HMI functions which support minimum as following; [D]
- display sequence number of AMAN in full data block track label
 - graphical time-line views of relevant calculated sequences and schedules of arrival flight
 - displays within the flight list, flight data block and flight data list components
 - landing/departure sequence displays for all runways
 - AMAN report in various standard format such as Excel, XML format.

8.12 Departure Manager

- DMAN01: The Tenderer shall provide product description of the proposed system detailing departure manager functionalities, capabilities and benefits. [D]
- DMAN02: The Tenderer shall propose and detail the methodology and parameters used to define the DMAN parameters. [D]
- DMAN03: The Tenderer shall propose and detail the methodology to help aerodrome control to build an optimized departure sequence issue in accordance with departure demand and capacity. [D]
- DMAN04: The Tenderer shall propose and detail the methodology to improve departure flows at one or more airports. [D]
- DMAN05: The Tenderer shall propose and detail the methodology to adjust the plan which supports the tactical handling of departures to aerodrome control. [D]
- DMAN06: The Tenderer shall propose and detail the methodology to support the runways in mixed mode operations. [D]

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8.13 Controller Pilot Data Link Communication

- CPDL01: The Tenderer shall provide product description of the proposed system detailing CPDLC functionalities, capabilities and benefits. [D]
- CPDL02: The Tenderer shall propose and detail the methodology and parameters used to define the CPDLC parameters. [D]
- CPDL03: The Tenderer shall propose and detail all message sets that are supported by CPDLC function. [D]
- CPDL04: The Tenderer shall propose and detail all CPDLC functionalities that are supported the controller pilot data link communication. [D]
- CPDL05: The Tenderer shall propose and detail the free text capability to exchange information. [E]
- CPDL06: The Tenderer shall propose and detail the auxiliary capability in order to forward a CPDLC message to another ground system. [E]

8.14 Air Situation Recording and Replay

- REC01: The Tenderer shall provide product description of the proposed system detailing recording and replay functionalities, capabilities and benefits. [D]
- REC02: The Tenderer shall propose and detail the graphical user interfaces for recording and replay functions. [D]
- REC03: The Tenderer shall propose and detail all data that are recorded by recording function with the purpose of recalled for replay and/or offline analysis. [E]
- REC04: The Tenderer shall propose and detail types of record disk that are used by record servers with the purpose of preventing loss of data during the recording, replaying [E]

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and archiving media processes.

- REC05: The Tenderer shall propose and detail the methodology to manage and report status of record function as follow: [E]
- Normal situation;
 - One of record disk fails;
 - One of record server fails; and
 - No archive media mounted in the unit.
- REC06: The Tenderer shall propose the maximum number of days in one retention period of record disk without overwritten by the new data. [E]
- REC07: The Tenderer shall propose and detail the methodology and parameters used to define the recording parameters. [E]
- REC08: The Tenderer shall propose the maximum number of CWS that can be replayed and managed by replay function simultaneously. [E]
- REC09: The Tenderer shall propose and detail all condition for the retrieval of recorded data that are supported by replay function. [E]
- REC10: The Tenderer shall propose and detail replay mode that are supported by replay function. [E]
- REC11: The Tenderer shall propose and detail the capabilities of replay control that are provided by replay function. [E]
- REC12: The Tenderer shall propose and detail the methodology to synchronize REP with DVR (Digital Voice Recorder). [E]
- REC13: The Tenderer shall propose the maximum number of audio channels that can be selected by replay function. [D]
- REC14: The Tenderer shall propose the maximum deviation time of synchronization between data and voice. [E]
- REC15: The Tenderer shall propose the maximum number of audio track that can be selected by replay function. [D]

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- REC16: The Tenderer shall propose and detail the replay speeds that are suitable for replay function. [E]
- REC17: The Tenderer shall propose and detail the specific tool for screen image capture. [E]
- REC18: The Tenderer shall propose and detail the specific tool for exporting short period replay. [E]
- REC19: The Tenderer shall propose and detail all type of archive media for the purpose of record and replay data, including export short period replay. [E]

8.15 Data Analysis

- DAAN01: The Tenderer shall provide product description of the proposed system detailing Data Analysis functionalities, capabilities and benefits. [D]
- DAAN02: The Tenderer shall propose and detail the facility to collect the recorded data and make them available for statistic and analysis. [D]
- DAAN03: The Tenderer shall propose and detail all statistical and analytical data that are created by data analysis function. [D]
- DAAN04: The Tenderer shall propose and detail all format of reports that are created by data analysis function. [E]
- DAAN05: The Tenderer shall propose and detail the facility to view the statistical data report and analytical data report. [D]
- DAAN06: The Tenderer shall propose and detail the methodology to create reports. [E]
- DAAN07: The Tenderer shall propose and detail the specific tools that are used for in depth inspection such as Safety Nets analysis, etc. [D]

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8.16 Aeronautical Information Management

- AIM01: The Tenderer shall provide product description of the proposed system detailing Aeronautical Information Management functionalities, capabilities and benefits. [D]
- AIM02: The Tenderer shall propose and detail all Aeronautical Information that are provided/supported to ATC. [D]
- AIM03: The Tenderer shall propose and detail the specific software tools for management of information with the purpose of preparing the aeronautical information to ATC. [D]
- AIM04: The Tenderer shall provide product description of the proposed system detailing the specific software tools functionalities, capabilities and benefits. [D]
- AIM05: The Tenderer shall propose and detail all aeronautical information that are provided by specific software tools. [D]
- AIM06: The Tenderer shall propose and detail all aeronautical information that are received from AFTN/ATN/Other System. [D]
- AIM07: The Tenderer shall propose and detail the AIM's capability and functionalities that are provided to ATC. [D]

8.17 Time Management

- TIME01: The Tenderer shall provide product description of the proposed system detailing Time Management functionalities, capabilities and benefits. [D]
- TIME02: The Tenderer shall propose and detail the conceptual diagram of time synchronization, protocol and standard date/time format that are used for synchronize time. [E]
- TIME03: The Tenderer shall propose and detail the methodology of Time Management in [E]

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order to synchronize time with time source of the system as follow:

- NAS MOPS, APP MOPS
- NAS CON/TRA, APP CON/TRA
- NAS IBS, APP IBS
- LTS
- RTS

TIME04: The Tenderer shall propose and detail the accuracy of time over any 24 hours period in the event of time source failed. [D]

8.18 CWS HMI

- CWS01: The Tenderer shall provide product description of the proposed system detailing CWS HMI functionalities, capabilities and benefits. [D]
- CWS02: The Tenderer shall propose and detail Individual CWS HMI configuration which based on the operator's role, login permissions, preferences and the sectorization plan. [E]
- CWS03: The Tenderer shall verify that the characteristic of CWS HMI meet standardization of "Luminance and Contrast" and "Visual Displays". [E]
- CWS04: The Tenderer shall propose and detail CWS HMI traffic situation presentation. [E]
- CWS05: The Tenderer shall propose and detail CWS HMI Traffic Situation Presentation which relevant to each operator role. [E]
- CWS06: The Tenderer shall propose and detail Number of Traffic Situation Presentation. [E]
- CWS07: The Tenderer shall propose and detail Main Traffic Situation window presentation [E]
- CWS08: The Tenderer shall propose and detail Inset Traffic Situation window presentation. [E]
- CWS09: The Tenderer shall propose and detail all windows on CWS HMI. [E]

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CWS10:	The Tenderer shall propose and detail the transparent or opaque windows.	[E]
CWS11:	In order to avoid hidden windows, the Tenderer shall propose and detail the indicator to inform what windows are obstructed.	[D]
CWS12:	The Tenderer shall propose and detail ATC tools on CWS HMI.	[D]
CWS13:	The Tenderer shall propose and explain all visual and audio alerts as follows. <ul style="list-style-type: none">• Hierarchical of alerts• Distinguish of higher and lower priority of alerts	[E]
CWS14:	The Tenderer shall propose and detail the number of different color palette of CWS HMI.	[D]
CWS15:	The Tenderer shall propose and detail the color configuration of CWS HMI	[E]
CWS16:	The Tenderer shall propose and detail all available quick keys	[E]
CWS17:	The Tenderer shall propose and detail the methodology to configure quick keys.	[E]
CWS18:	The Tenderer shall propose and detail Map contents.	[E]
CWS19:	The Tenderer shall propose and detail online and offline Map configuration.	[E]
CWS20:	The Tenderer shall propose and detail the suitable tools for Map drawing and creation.	[E]
CWS21:	The Tenderer shall propose a maximum number of maps that can present on CWS HMI.	[D]
CWS22:	The Tenderer shall propose maximum temporary maps that can be created and stored on each CWS HMI.	[D]
CWS23:	The Tenderer shall propose and detail track presentation position symbols	[D]
CWS24:	The Tenderer shall propose and detail history trail of track/plot.	[D]
CWS25:	The Tenderer shall propose and detail leader line.	[D]

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CWS26:	The Tenderer shall propose and detail predicted track vector.	[D]
CWS27:	The Tenderer shall propose and detail Full Data blocks.	[D]
CWS28:	The Tenderer shall propose and detail Limited Data blocks	[D]
CWS29:	The Tenderer shall propose and detail control panels.	[D]
CWS30:	The Tenderer shall propose and detail geographical reroute HMI.	[D]
CWS31:	The Tenderer shall propose and detail electronic strip field.	[D]
CWS32:	The Tenderer shall propose and detail electronic strip presentation.	[D]
CWS33:	The Tenderer shall propose and detail Flight data Entry Interaction.	[D]
CWS34:	The Tenderer shall propose and detail Flight data list windows.	[E]
CWS35:	The Tenderer shall propose and detail the intensity adjustment of the graphical and tabular items displayed on CWS HMI.	[E]
CWS36:	The Tenderer shall propose and detail Meteorological Information Presentation.	[E]
CWS37:	The Tenderer shall propose and detail Aeronautical Information Presentation	[E]
CWS38:	The Tenderer shall propose and detail Paged Information Presentation.	[E]
CWS39:	The Tenderer shall propose and detail operational status of the system.	[E]
CWS40:	The Tenderer shall propose and detail both on line and offline of CWS HMI configuring tool as follows: <ul style="list-style-type: none">• layout of push-buttons/menus/Electronic Strip• definition of the maps• default range and offset• definition and layout of the plot and track labels• preferences and manipulation of jurisdiction	[E]

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8.19 FDO HMI

- FDO01: The Tenderer shall provide product description of the proposed system detailing FDO HMI functionalities, capabilities and benefits. [D]
- FDO02: The Tenderer shall propose and detail flight data list HMI. [D]
- FDO03: The Tenderer shall propose and detail managing ATS messages and flight plan data to ensure flight data correctness and completeness of each flight plan for smooth transition of flight progress. [D]
- FDO04: The Tenderer shall propose and detail free text input concerning individual flight plans to display in relevant Flight Data Block, Electronic Flight Strip and Flight Data List. [D]
- FDO05: The Tenderer shall propose and detail managing specific dynamic aeronautical data by modification, creation and cancellation of the data as appropriate. [D]
- FDO06: The Tenderer shall propose and detail the methodology of managing weather data including, at least, meteorological messages. [D]
- FDO07: The Tenderer shall propose and detail the methodology for the operator to retrieve desired flight plans. [D]
- FDO08: The Tenderer shall propose the capability to print, at least, flight plan data, flight plan history, aeronautical data and meteorological data onto a printer. [E]

8.20 Data Set Management

- DSM01: The Tenderer shall provide product description of the proposed system detailing Data Set Management functionalities, capabilities and benefits. [D]
- DSM02: The Tenderer shall propose and detail the methodology to prevent unauthorized user access to data set management facility. [E]

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DSM03:	The Tenderer shall propose and detail the methodology to prevent inconsistent static environment data that are used by many functions (e.g. CWS's Maps, FDP, and Monitoring Aids).	[E]
DSM04:	The Tenderer shall propose and detail list of provided hardware, accessories, related software, integration procedure, reference documents, essential software tool(s) and training course for reconfiguration the data set/system parameters.	[D]
DSM05:	The Tenderer shall propose and detail all data set that are supported by data set management.	[D]
DSM06:	The Tenderer shall propose and detail the facility to manage the data set which provided to data set management function.	[E]
DSM07:	The Tenderer shall propose and detail the facility for import the aeronautical data from external system in AIXM messages format.	[D]
DSM08:	The Tenderer shall propose and detail all aeronautical data that are imported from external system.	[D]
DSM09:	The Tenderer shall propose version of AIXM message format which supported by data set management function.	[D]
DSM10:	The Tenderer shall propose and detail the facility to backup and restore data set to/from archive media.	[E]
DSM11:	The Tenderer shall propose type of archive media that are supported with the purpose of backup and restore the data set.	[E]
DSM12:	The Tenderer shall propose and detail the map editor's features and functionalities in order to create/edit all aeronautical maps.	[E]
DSM13:	The Tenderer shall propose and detail all aeronautical maps that are supported by map generator.	[D]
DSM14:	The Tenderer shall propose and detail the facility and methodology to upload data set to all related systems/functions.	[E]

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DSM15: The Tenderer shall propose and detail the facility and methodology to activate the new data set. [E]

8.21 Network Management System

NMS01: The Tenderer shall provide product description of the proposed system detailing NMS functionalities, capabilities and benefits. [D]

NMS02: The Tenderer shall propose and detail the capability of all functions in NMS application that are provided, including at a minimum: [E]

- network resource monitoring
- routes analytics
- Network configuration management
- fault management
- performance management

NMS03: The Tenderer shall propose and detail the NMS application in order to enhance management of network equipments/resources such as network switches and routers, etc. [E]

8.22 Control and Monitoring System

CMS01: The Tenderer shall provide product description of the proposed system detailing CMS functionalities, capabilities and benefits. [D]

CMS02: The Tenderer shall propose and detail all system control capabilities of CMS, including at a minimum: [E]

- Manual redundant servers switchover,
- Manual redundant external input switchover;

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- Inhibit, exhibit data line inputs;
- Manual Start, Stop function.

- CMS03: The Tenderer shall propose and detail all system monitoring capabilities of CMS, including at a minimum: [E]
- Functions status such as SDP,FDP, etc.;
 - External interfaces status including channel in used, channel problem, etc.;
 - Internal network status including network equipment such as switches, router, etc.;
 - GPS time server status and time synchronization status; and
 - Performance Monitoring such as CPU, Memory, Storage, Network utilization, etc.
- CMS04: The Tenderer shall propose and detail the following capability of CMS [E]
- Alarm indication methods;
 - Type of network management protocols;
 - The method to keep log files and duration period for keeping log files available.
- CMS05: The Tenderer shall propose and detail authorization levels available for access to the different CMS function sets and configuration methods for those levels. [D]

8.23 Contingency/Training System

- COTA01: The Tenderer shall provide product description of the proposed system detailing CON/TRA in Contingency mode functionalities, capabilities and benefits. [D]
- COTA02: The Tenderer shall propose and detail the functional capabilities of NAS CON/TRA in Contingency mode in comparison to NAS MOPS functional capabilities. [E]
- COTA03: The Tenderer shall propose and detail the functional capabilities of each APP CON/TRA in Contingency mode in comparison to its corresponding APP MOPS functional capabilities. [E]

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COTA04:	The Tenderer shall propose and detail the methodology to synchronize all information between NAS CON/TRA and NAS MOPS.	[E]
COTA05:	The Tenderer shall propose and detail the methodology to synchronize all information between each APP CON/TRA and its corresponding APP MOPS.	[E]
COTA06:	The Tenderer shall propose the software version of NAS CON/TRA in Contingency mode software in comparison to NAS MOPS software.	[E]
COTA07:	The Tenderer shall propose the software version of each APP CON/TRA in Contingency mode software in comparison to its corresponding APP MOPS software.	[E]
COTA08:	The Tenderer shall propose and detail the methodology to reconfigure the CON/TRA from the Training mode to Contingency mode, and vice versa.	[E]
COTA09:	The Tenderer shall propose the usage time to reconfigure the CON/TRA from the Training mode to Contingency mode, and vice versa.	[E]
TRA01:	The Tenderer shall provide product description of the proposed system detailing CON/TRA in Training mode functionalities, capabilities and benefits.	[D]
TRA02:	The Tenderer shall propose and detail the capability of games feature in the CON/TRA in Training mode.	[E]
TRA03:	The Tenderer shall propose and detail the capability of session feature in the CON/TRA in Training mode.	[E]
TRA04:	The Tenderer shall propose and detail the capability of exercise feature in the CON/TRA in Training mode.	[E]
TRA05:	The Tenderer shall propose and detail the TEG capability, including at a minimum: <ul style="list-style-type: none"> • Maximum number of Flight that TEG can create ; • Maximum number of Flight plan messages that TEG create; • Detail of Aeronautical information data that TEG can handle; • Maximum type of Wind and Weather data that TEG can create; • Maximum number of Aircraft simulation that TEG can handle; 	[E]

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- Maximum number and type of Surveillance data that TEG can simulate.
- Maximum number of CPDLC message that TEG can create ;
- Time management.
- Maximum types of Report generation and their detail.

TRA06:	The Tenderer shall propose and detail all the PSP functions and capabilities.	[E]
TRA07:	The Tenderer shall propose maximum number of flights each PSP can assume.	[E]
TRA08:	The Tenderer shall propose and detail the TMC capability including, at a minimum, session management, game management, exercise management and CWS grouping.	[E]
TRA09:	The Tenderer shall propose maximum number of exercises that can be run simultaneously by TMC.	[E]
TRA10:	The Tenderer shall propose maximum number of TRN positions that can to run per one exercise.	[E]
TRA11:	The Tenderer shall propose maximum number of PSP positions that can be run per one exercise.	[E]

8.24 Computer Based Training Software

CBT01:	The Tenderer shall propose and detail the Computer Based Training Software (CBT) for the learner to understand the functional features, capabilities and usage of TMCS.	[D]
CBT02:	The Tenderer shall propose and detail the course contents of CBT and learner group for each course.	[D]
CBT03:	The Tenderer shall propose and detail the training record management feature and performance.	[D]
CBT04:	The Tenderer shall propose and detail the security management features of CBT.	[D]

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CBT05:	The Tenderer shall propose and detail the procedure or solution to organize the training course (for example classroom solution and/or self-learning solution – online/offline).	[D]
CBT06:	The Tenderer shall propose and detail the training assessment features of the CBT.	[D]
CBT07:	The Tenderer shall propose and detail the web-based of CBT.	[D]
CBT08:	The Tenderer shall propose the maximum number of simultaneous users supported by CBT.	[D]
CBT09:	The Tenderer shall propose and detail the hardware configuration best suited for CBT.	[D]

8.25 Tower Surveillance Data Processing

TSDP01:	The Tenderer shall provide product description of the proposed system detailing TSDP functionalities, capabilities and benefits.	[D]
TSDP02:	The Tenderer shall provide product description of the proposed system detailing SUF features	[E]
TSDP03:	The Tenderer shall propose and detail the combination algorithm of data from several sources to provide a single target.	[E]
TSDP04:	The Tenderer shall propose the update time range used for Track identification.	[E]
TSDP05:	The Tenderer shall propose and detail the format of data output of SUF.	[E]
TSDP06:	The Tenderer shall provide product description of the proposed system detailing COF features.	[E]
TSDP07:	The Tenderer shall propose and detail all types of automatic conflict detection and alerting.	[E]

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- TSDP08: The Tenderer shall propose and detail of all scenarios of Runway Incursions. [E]
- TSDP09: The Tenderer shall propose and detail of all scenarios of Taxiway Conflicts. [E]
- TSDP10: The Tenderer shall propose and detail of all scenarios of Area Conflicts. [E]
- TSDP11: The Tenderer shall propose and detail of all scenarios of Special Conflicts. [E]
- TSDP12: The Tenderer shall propose and detail all alert/alarm indication methods, when COF detects a conflict situation. [E]
- TSDP13: The Tenderer shall propose the update time range of conflict alerts. [E]
- TSDP14: The Tenderer shall propose and detail all the parameters used for conflict alert detection. [E]

8.26 Tower Flight Data Processing

- TFDP01: The Tenderer shall provide product description of the proposed system detailing TFDP functionalities, capabilities and benefits. [D]
- TFDP02: The Tenderer shall provide product description of the proposed system detailing Data Management and Update features. [E]
- TFDP03: The Tenderer shall propose and detail how the TFDP transfer the aircraft to FDP. [E]
- TFDP04: The Tenderer shall propose and detail the coordination between TFDP and FDP. [E]
- TFDP05: The Tenderer shall provide product description of the proposed system detailing Runway Determination feature. [E]
- TFDP06: When the departure or arrival runway for a given flight changed, the Tenderer shall propose and detail the affected time-related information items and SID/STAR. [E]

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- TFDP07: The Tenderer shall provide product description of the proposed system detailing Correlation with Surveillance data features. [E]
- TFDP08: The Tenderer shall provide product description of the proposed system detailing SSR code assignment and management features. [E]

8.27 Tower Controller Workstation (T-CWS)

- TCWS01: The Tenderer shall provide product description of the proposed system detailing T-CWS functionalities, capabilities and benefits. [D]
- TCWS02: The Tenderer shall provide product description of the proposed system detailing ASD functionalities, capabilities and benefits. [E]
- TCWS03: In case of the servers fail, The Tenderer shall propose how the ASD present the actual traffic situation. [E]
- TCWS04: The Tenderer shall provide product description of the proposed system detailing Track presentation of ASD. [E]
- TCWS05: The Tenderer shall provide product description of the proposed system detailing Label presentation of ASD. [E]
- TCWS06: The Tenderer shall provide product description of the proposed system detailing GSD functionalities, capabilities and benefits. [E]
- TCWS07: In case of the servers fail, The Tenderer shall propose how the GSD present the actual ground traffic situation. [E]
- TCWS08: The Tenderer shall provide product description of the proposed system detailing configuration of multiple-view layout, pop up views and pre-selected area features. [E]
- TCWS09: The Tenderer shall provide product description of the proposed system detailing tools to operators to re-arrangement of the screen, Switching map overlays, [E]

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Bearing/Distance line.

TCWS10:	The Tenderer shall provide product description of the proposed system detailing Track presentation of GSD.	[E]
TCWS11:	The Tenderer shall provide product description of the proposed system detailing Label presentation of GSD.	[E]
TCWS12:	The Tenderer shall provide product description of the proposed system detailing display customization features.	[E]
TCWS13:	The Tenderer shall provide product description of the proposed system detailing FDD functionalities and features.	[E]
TCWS14:	The Tenderer shall provide product description of the proposed system detailing bays presentation.	[E]
TCWS15:	The Tenderer shall provide product description of the proposed system detailing tools of flight data management and update.	[E]
TCWS16:	The Tenderer shall provide product description of the proposed system detailing type of strip bay.	[E]
TCWS17:	The Tenderer shall propose and detail all data contain in Tower Electronic Flight Strip (TEFS) and how to configure the data.	[E]
TCWS18:	The Tenderer shall propose and detail all display formats for the TEFS.	[E]
TCWS19:	The Tenderer shall provide product description of the proposed system detailing how to change state of the FPL.	[E]
TCWS20:	The Tenderer shall provide product description of the proposed system detailing handwriting features.	[E]
TCWS21:	The Tenderer shall provide product description of the proposed system detailing Free Text Insert (FTI) features.	[E]
TCWS22:	The Tenderer shall provide product description of the proposed system detailing notification display.	[E]

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TCWS23:	The Tenderer shall provide product description of the proposed system detailing auxiliary data display.	[E]
TCWS24:	The Tenderer shall provide product description of the proposed system detailing Runway in use management features.	[E]
TCWS25:	The Tenderer shall provide product description of the proposed system detailing FDD degraded mode features.	[E]
TCWS26:	The Tenderer shall provide product description of the proposed system detailing grouping / re-grouping of the role features.	[E]
TCWS27:	The Tenderer shall provide product description of the proposed system detailing T-DSM functionalities, capabilities and benefits.	[E]
TCWS28:	The Tenderer shall provide product description of the proposed system detailing T-NMS functionalities, capabilities and benefits.	[E]
TCWS29:	The Tenderer shall provide product description of the proposed system detailing T-CMS functionalities, capabilities and benefits.	[E]

9 Technical Characteristic Submittal

9.1 Workstations Characteristic

- WRKC01: The Tenderer shall propose the technical specifications data of the Workstation-grade Computers that are provided for Type A Workstation including all attached devices which specifies, at minimum, the following aspects/features [E]
- Brand and Model;
 - CPU performance;
 - type and capacity of Memory;
 - Graphic card;

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	<ul style="list-style-type: none">• Network interface card; and• Mean Time Between Failure value of each component.	
WRKC02:	The Tenderer shall propose and detail the Power supply of the Workstation-grade Computers that are provided for Type A Workstation.	[E]
WRKC03:	The Tenderer shall propose and detail The Main LCD Monitor of Type A Workstation which specifies, at minimum, the following aspects/features: <ul style="list-style-type: none">• Brand and Model; and• Technical specification data details.	[E]
WRKC04:	The Tenderer shall propose and detail The Extended LCD Monitor of Type A Workstation which specifies, at minimum, the following aspects/features: <ul style="list-style-type: none">• Brand and Model; and• Technical specification data details.	[E]
WRKC05:	The Tenderer shall propose the technical specifications data of the Workstation-grade Computers that are provided for Type B Workstation including all attached devices which specifies, at minimum, the following aspects/features <ul style="list-style-type: none">• Brand and Model;• CPU performance;• type and capacity of Memory;• Graphic card;• Network interface card; and• Mean Time Between Failure value of each component.	[E]
WRKC06:	The Tenderer shall propose and detail the Power supply of the Workstation-grade Computers that are provided for Type B Workstation.	[E]
WRKC07:	The Tenderer shall propose and detail The LCD Monitor of Type B Workstation which specifies, at minimum, the following aspects/features: <ul style="list-style-type: none">• Brand and Model; and• Technical specification data details.	[E]
WRKC08:	The Tenderer shall propose the technical specifications data of the Workstation-grade Computers that are provided for Type C Workstation including all attached devices which specifies, at minimum, the following aspects/features	[E]

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	<ul style="list-style-type: none">• Brand and Model;• CPU performance;• type and capacity of Memory;• Graphic card;• Network interface card; and• Mean Time Between Failure value of each component.	
WRKC09:	The Tenderer shall propose and detail the Power supply of the Workstation-grade Computers that are provided for Type C Workstation.	[E]
WRKC10:	The Tenderer shall propose and detail The LCD Monitor of Type C Workstation which specifies, at minimum, the following aspects/features: <ul style="list-style-type: none">• Brand and Model; and• Technical specification data details.	[E]
WRKC11:	The Tenderer shall propose the technical specifications data of the Workstation-grade Computers that are provided for Type D Workstation including all attached devices which specifies, at minimum, the following aspects/features <ul style="list-style-type: none">• Brand and Model;• CPU performance;• type and capacity of Memory;• Graphic card;• Network interface card; and• Mean Time Between Failure value of each component.	[E]
WRKC12:	The Tenderer shall propose and detail the Power supply of the Workstation-grade Computers that are provided for Type D Workstation.	[E]
WRKC13:	The Tenderer shall propose and detail The LCD Monitor of Type D Workstation which specifies, at minimum, the following aspects/features: <ul style="list-style-type: none">• Brand and Model; and• Technical specification data details.	[E]
INPD01:	The Tenderer shall propose the detail of input and pointing devices characteristic of workstation.	[E]

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9.2 Server Computer

- SRVC01: The Tenderer shall propose the technical specifications data of the provided Server Computers including all attached devices which specifies, at minimum, the following aspects/features: [E]
- Brand and Model;
 - CPU performance;
 - type, performance, and capacity of Memory;
 - Network interface card;
 - Power Supply;
 - type, performance, capacity of Storage device; and
 - Mean Time Between Failure value of each component.

9.3 Printers

- PRNT01: The Tenderer shall propose the List of supply of the printers that are provided. [E]
- PRNT02: The Tenderer shall propose and detail the Networked Color Laser printers which specifies, at minimum, the following aspects/features: [E]
- Brand and Model; and
 - Technical specification data details.

9.4 Console

- CONS01: The Tenderer shall propose the List of supply of console and seats, to support the operation in Operational partition, CON/TRA partition of BACC/BAPC, CMA APC, HTY APC, PUT APC, PSL APC, HHN APC and LTS/RTS. [E]
- CONS02: The Tenderer shall propose the conceptual design for each type of consoles that showing all design details, dimensions, colour scheme and materials to be used for [D]

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each component of the console.

- CONS03: The Tenderer shall propose the conceptual design of console layout arrangement of each room of the operation in Operational partition, CON/TRA partition of BACC/BAPC, CMA APC, HTY APC, PUT APC, PSL APC, HHN APC and LTS/RTS. [D]
- CONS04: The Tenderer shall propose and describe in detail the specific characteristics of each type of console as follows; [D]
- Heat ventilation;
 - Console Illumination;
 - Power distribution unit;
 - Equipment Housing and cabinet;
 - Material & Color; and
 - Noise attenuation characteristic.

9.5 Reliability, Availability, and Maintainability (RAM)

- RAMA01: The Tenderer shall propose and detail the RAM predictions and analysis for the proposed system. [E]
- RAMA02: The Tenderer shall provide detail design of the system that will be continuously operated to meet the RAM values. [E]
- RAMA03: The Tenderer shall provide the duration for each running step of the operating and application software installed in all servers and workstations from cold (i.e. switched-off)/ warm (restart) to full system capabilities are available. [E]
- RAMA04: The Tenderer shall propose and detail the RAM monitoring for each system. [E]
- RAMA05: The Tenderer shall provide the MTTR of each type of proposed equipment units. [E]
- RAMA06: The Tenderer shall propose and detail the availability of the proposed system. [E]

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9.6 Performance and Capacity

- SPFC01: The Tenderer shall identify the System Performance and Capacity of the proposed system including at least the following items. [E]
- Maximum System Coverage Area;
 - Maximum Height;
 - Maximum number of Received plots per scan per radar;
 - Maximum number of Concurrent System Tracks;
 - Maximum number of Concurrent System Flight Plans in all states;
 - Display Range;
 - Maximum Number of tracks displayable in Situation Display; and
 - Maximum number of Display Graphic Maps.
- SPFC02: The Tenderer shall identify the Maximum response time on commands to execution completed at CWS and T-CWS. [E]
- SPFC03: The Tenderer shall identify the Maximum response time on commands to execution completed involve flight plan handling (e.g. route modification) at CWS and T-CWS. [E]
- SPFC04: The Tenderer shall identify the maximum time required for complete system start-up from cold (i.e. switched-off) to full system capabilities are available. [E]
- SPFC05: The Tenderer shall identify the maximum time required for automatic switchover of a failed component of the radar processing chain (radar interfaces equipments and tracking processors). [E]
- SPFC06: The Tenderer shall identify the maximum time required in case of automatic switchover of any other failed component to its standby. [D]
- SPFC07: The Tenderer shall identify the maximum time required to configure a workstation, already powered-up and allocated to operational mission, for operation at a sector. [E]
- SPFC08: The Tenderer shall identify the maximum time required for complete start-up of a CWS from a powered-off state to complete operation at a sector. [E]

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9.7 Design Principles

- DESP01: The Tenderer shall propose and describe in detail of the maximum memory usage and CPU usage of each Server and Workstation-grade computer whilst providing the maximum capacity. [E]
- DESP02: The Tenderer shall propose and detail Database Management system used in the provided systems. [D]
- DESP03: The Tenderer shall propose and detail the provided Operating System of Server and Workstation-grade computer. [E]
- DESP04: The Tenderer shall specify the rate of transmission of Ethernet frames (100 Mbps, 1000 Mbps, etc.) of all equipments (servers, workstation-grade computer, network equipment, etc.) for the proposed system. [E]
- DESP05: The Tenderer shall propose and describe in detail of each Networking equipment and Interface devices which specifies, at minimum, the following aspects/features: [E]
- Brand and Model;
 - Technical specification data details.
 - Power Supply; and
 - Mean Time Between Failure value.
- DESP06: The Tenderer shall propose and detail the Time Reference System configuration and describe the Time synchronization methodology for the MOPS, CON/TRA, IBS and external systems. [E]
- DESP07: The Tenderer shall propose and describe in detail of Time Reference equipment which specifies, at minimum, the following aspects/features: [E]
- Brand and Model;
 - Technical specification data details.
 - Power Supply; and
 - Mean Time Between Failure value.

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9.8 Uninterrupted Power Supply

UPS01:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Tung Mahamek Site.	[E]
UPS02:	The Tenderer shall propose and detail the connection between metro electric/engine to the UPS at Tung Mahamek Site.	[E]
UPS03:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Tung Mahamek Site.	[E]
UPS04:	The Tenderer shall propose the list of supplies of UPS equipments and related components for Tung Mahamek Site.	[E]
UPS05:	The Tenderer shall provide product description/Technical Characteristics of UPS systems, Static Transfer Switch, and other related components at Tung Mahamek Site.	[D]
UPS06:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Chiang Mai Site.	[E]
UPS07:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Chiang Mai Site.	[E]
UPS08:	The Tenderer shall propose the list of supplies of UPS equipments and related components for Chiang Mai Site.	[E]
UPS09:	The Tenderer shall provide product description/Technical Characteristics of UPS systems, Static Transfer Switch, and other related components at Chiang Mai Site.	[D]
UPS10:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Hat Yai Site.	[E]
UPS11:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Hat Yai Site.	[E]
UPS12:	The Tenderer shall propose the list of supplies of UPS equipments and related	[E]

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components for Hat Yai Site.

UPS13:	The Tenderer shall provide product description/Technical Characteristics of UPS systems, Static Transfer Switch, and other related components at Hat Yai Site.	[D]
UPS14:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Phuket Site.	[E]
UPS15:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Phuket Site.	[E]
UPS16:	The Tenderer shall propose the list of supplies of UPS equipments and related components for Phuket Site.	[E]
UPS17:	The Tenderer shall provide product description/Technical Characteristics of UPS systems, Static Transfer Switch, and other related components at Phuket Site.	[D]
UPS18:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Phitsanulok Site.	[E]
UPS19:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Phitsanulok Site.	[E]
UPS20:	The Tenderer shall propose the list of supplies of UPS equipments and related components for Phitsanulok Site.	[E]
UPS21:	The Tenderer shall provide product description/Technical Characteristics of UPS systems, Static Transfer Switch, and other related components at Phitsanulok Site.	[D]
UPS22:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Hua Hin Site.	[E]
UPS23:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Hua Hin Site.	[E]
UPS24:	The Tenderer shall propose the list of supplies of UPS equipments and related components for Hua Hin Site.	[E]
UPS25:	The Tenderer shall provide product description/Technical Characteristics of UPS	[D]

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systems, Static Transfer Switch, and other related components at Hua Hin Site.

UPS26:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Samui Airport Site.	[E]
UPS27:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Samui Airport Site.	[E]
UPS28:	The Tenderer shall propose the list of supplies of UPS equipments and related components for Samui Airport Site.	[E]
UPS29:	The Tenderer shall provide product description/Technical Characteristics of UPS systems, Static Transfer Switch, and other related components at Samui Airport Site.	[D]
UPS30:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Udon Thani Airport Site.	[E]
UPS31:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Udon Thani Airport Site.	[E]
UPS32:	The Tenderer shall propose the list of supplies of UPS equipments and related components for Udon Thani Airport Site.	[E]
UPS33:	The Tenderer shall provide product description/Technical Characteristics of UPS systems, Static Transfer Switch, and other related components at Udon Thani Airport Site.	[D]
UPS34:	The Tenderer shall propose and detail the UPS configuration best suited for all systems at Nakhon Si Thammarat Airport Site.	[E]
UPS35:	The Tenderer shall propose and detail the wiring diagram from UPS to equipments at Nakhon Si Thammarat Airport Site.	[E]
UPS36:	The Tenderer shall propose the list of supplies of UPS equipments and related components for Nakhon Si Thammarat Airport Site.	[E]
UPS37:	The Tenderer shall provide product description/Technical Characteristics of UPS	[D]

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systems, Static Transfer Switch, and other related components at Nakhon Si Thammarat Airport Site.

- | | | |
|--------|--|-----|
| UPS38: | The Tenderer shall propose and detail the UPS configuration best suited for systems at all Level-II Airport Sites. | [E] |
| UPS39: | The Tenderer shall propose and detail the wiring diagram from UPS to equipments at all Level-II Airport Sites. | [E] |
| UPS40: | The Tenderer shall propose the list of supplies of UPS equipments and related components for all Level-II Airport Sites. | [E] |
| UPS41: | The Tenderer shall provide product description/Technical Characteristics of UPS systems, Static Transfer Switch, and other related components at all Level-II Airport Sites. | [D] |

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PART-2 : SCOPE OF SPECIFICATIONS

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SECTION A Other Qualifications

Tenderers are requested to submit their responses in four (4) categories. Each category shall be detailed as per the format and enclosing the supporting documents listed in the format.

1 Details of the Organization

Detail of the Organization	
Name	
Nature of business (b)	
Date of Commencement of Business (a)	
Address of the Headquarters	
Other Relevant Information	
Supporting Documents: a) Certificate of Incorporation b) Relevant sections of Memorandum of Association of the company or filings to the stock exchanges to indicate the nature of business of the company	

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2 Financial Strength Details

Tenderer shall provide only details in air traffic management business.

Financial Information					
	2011-10	2010-09	2009-08	2008-07	2007-06
Revenue					
Profit Before Tax					
Other Relevant Information					
Supporting Documents:					
a) Auditor Certified financial statements for the Last five financial years as on financial year 2012; (Please include only the sections on P&L, revenue and the assets, not the entire balance sheet.)					

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3 Proof of Project Experiences

The Tenderer shall provide a details of a proven track record of directly responsible for a successful implementation of project in the provision of system for air traffic management in the last 5 years as on 1st January 2011 as per project.

Project Past Experience (as per project)	
General Project Information:	
Name of the project	
Client for which the project was executed	
Name and contact details of the client	
Project Details	
Description of the project	Summary details of the scope of the project shall be provided (which are part of evaluation criteria).
Scope of services	
Outcomes of the project	

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Other Details	
Total cost of the project	
Duration of the project (no. of months, start date, completion date, current status)	
Other Relevant Information	
Supporting Documents:	a) Letter from the client to indicate the successful completion of the projects b) Copy of Work Order

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4 Proof of Certification

The Tenderer shall provide a copy of certificate and details of assessment of the required certification (CMMI Level 5 and ISO 27001 or above)

Format for the Proof of Certification	
Certification for CMMI-level 5	
Certifying Agency	
Certified date	
Mandatory Supporting Documents:	a) The last valid CMMI Level 5 certificate of the company. b) A proof from the certifying agency stating that the renewal of the certification is under progress and the date when such renewal was applied for by the company.
Certification for ISO 27001	
Certifying Agency	
Certified date	
Supporting Documents:	a) copy of certificate as on the date of contract signing and the certificate should be valid for at least a period of one year from the date of submission of the bid.

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AERONAUTICAL RADIO OF THAILAND

BANGKOK, THAILAND

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PART 3:

SUPPORT AND AFTER SALE SERVICE

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INTRODUCTION

PART-3 describes supported items and post implementation Activities requirement for TMCS in order to sustain its operability through to the end of system lifecycle. Such requirement, including but not limited to Training, Documentation, and Spare Part will be provided. In addition, PART-3 contains guideline information for Tenderers to understand the purpose of AEROTHAI's requirements and contains specifications requirement of related Activities and supported items for Tenderers to submit their response to the requirements.

SECTION B SUPPORT AND AFTER SALE SERVICE

1 Service Life

The TMCS should be designed to have a service life of at least fifteen (15) years. The after sale supports, including but not limited to the continued availability of spare parts for direct purchase by AEROTHAI and the supply of new application software if the Seller make an improvement or modification to accommodate the new operating system version and/or hardware version will be available through the service life of TMCS..

2 Warrantee

The warrantee of the TMCS is at least three (3) years on-site services warranty for hardware and software. The warranty period will be started after the project completion date.

The Seller will be liable to the logistics and maintenance support during the warranty period. Such support consists of repair and/or replacement of system, equipments and parts.

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3 Training

3.1 General

The Training programs will be conducted to train AEROTHAI's staffs who are TMCS operator, system operator, maintenance engineer and related officer. The Training program will include all aspects of the systems operation and maintenance. The Training programs, including:

- a) Schedule of the training courses;
- b) Objective, syllabus and duration of each training course;
- c) List of training materials and documentation to be included with the training course;
- d) Qualifications and experience level necessary for the personnel to be trained;
- e) Qualification of the instructors; and
- f) Course method or training mode.

After awarding the contract, Seller will conduct meeting with AEROTHAI to review the details of the Training Schedule and training course. .

The Seller training manager will be assigned to be responsible for training and serve as the contact point for all matters related to training.

All training will be conducted by personnel who are fully conversant with the subject they are teaching, and have an excellent command of the English language.

All training instructions and documentation will be in English language.

For those training courses to be conducted in AEROTHAI, AEROTHAI will provide classroom with desks, a whiteboard, projector, and common stationery.

The certificate of competence will be issued to AEROTHAI's staffs who have attended the training course(s) and pass the required examination.

All price shall be included in the Price Proposal.

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3.2 Database Management System Training

The Database Management System Training (DMST) will be conducted at the Factory. DMST will be provided, at least, four (4) operational staffs to train them as Database Management System (DMS) specialist staff.

The course will achieve the following objectives:

- a) Establish an expert DMS understanding in the DMS logic and architecture; and
- b) Establish expert competence in the adding, modifying, deleting, adjusting, manipulating, validating and managing the DMS offline parameters.

The DMST course content will include at least the following:

- a) DMS structure, logic and content;
- b) Operating of the DMS preparation toolbox;
- c) Creation, modification and deletion of the adaptation database;
- d) Validating the created or modified adaptation database; and
- e) Managing and maintaining the adaptation database.

On completion of this course, the participants will be able to successfully operate, create and manage the DMS.

Additionally, the participants will have an understanding cognizant with successfully training other officers as DMS specialists.

3.3 Air Traffic Control Operational Train the Trainer Training

The Seller will provide ATC Operational Train the Trainer Training (ATCTT), at Factory, as follows:

- a) ATCTT will be provided for up to twenty-four (24) Staffs. The objectives for this course will be to:
 - Establish an expert level of theoretical understanding cognizant of writing documentation and practical training programs for operational staff;

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- Establish an expert competency level of CWS operating ability cognizant of training operational ATC; and
 - Establish an expert level of system understanding cognizant of creating competency criteria for theoretical knowledge and CWS operating competency.
- b) The ATCTT course content will include at least the following:
- System overview;
 - System architecture;
 - Degraded modes of operation;
 - The Level of Contingency and backup;
 - Intersystem Connection;
 - Operator Roles and Workstations;
 - VCCS;
 - System Functionalities;
 - State of flight and/or flight plan life cycle;
 - Automatic Dependent Surveillance (ADS);
 - Controller Pilot Data Link Communications (CPDLC); and
 - ATS Interfacility Data Communications (AIDC).
- c) On completion of this course, participants will:
- Have expert competence operating the CWS position; and
 - Have a theoretical and practical understanding cognizant with developing and delivering conversion training courses to ATC.

3.4 Flight Data Operator Train the Trainer Training

The Flight Data Operator Train the Trainer Training (FDTT) will be provided as follows:

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- a) FDTT will be provided for up to ten (10) staffs. The objectives of this course will:
 - Establish an expert level of theoretical understanding cognizant of writing documentation and practical training programs for operational staff;
 - Establish an expert competency level of FDO operating ability cognizant of training operational FDO's; and
 - Establish an expert level of system understanding cognizant of creating competency criteria for theoretical knowledge and FDO operating competency.
- b) The FDTT course content will include at least the following:
 - Overview of system architecture;
 - Concept of the Flight Data Processing;
 - The role of FDO;
 - FDO functions;
 - Overview and description of controller functions;
 - Message queue management;
 - Creation and management of repetitive flight plans;
- c) On completion of this course participants will:
 - have expert competence operating the FDO position; and
 - have a theoretical and practical understanding cognizant with developing and delivering appropriate training courses to other FDO.

3.5 Training Supervisor/Instructor Training

The Seller will provide Training (TRA) Supervisor and Instructor (TRAS/I) training will be provided for up to twelve (12) Staffs.

The objectives of the TRAS/I course will be:

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- Establish an expert level of TRA knowledge cognizant of managing the training operations of the TRA system;
- Establish an expert level of TRA knowledge cognizant of developing training exercises; and
- Establish an expert level of TRA pilot functions cognizant of developing and delivering training for TRA pilots.
- completion of this course, participants will be able to successfully manage the TRAs' operations, develop and conduct training exercises and conduct simulator pilot training.

3.6 TRA Pseudo-pilot Training

TRA Pseudo-pilot (TRAP) training will be provided for up to thirty (30) Staffs.

On completion, participants will be able to satisfy the assessment standard and to discharge their roles as pilot when they are engaged in SIM training session.

3.7 Factory Maintenance Training

The Seller will provide factory maintenance training at Seller's factory for up to eighteen (18) surveillance engineer staffs and fourteen (14) VCCS engineer staffs who have basic software knowledge and will be involved in the factory acceptance, installation, acceptance, training and subsequent maintenance of the System.

The training will include courses that will enable the engineer staff to gain an appreciation of the overall systems/equipment used and its operation as follows:

- a) Basic level training for surveillance engineer staffs will include at least the following:
 - TMCS system overview and system architecture;
 - TMCS system network;
 - Intersystem connection and external interface;
 - Air – Ground/ Ground – Ground data link communication such as DCL, CPDLC, etc.;
 - Degrade mode of operation;

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- The level of contingency and backup;
 - The TMCS's hardware devices;
 - Software components of the TMCS;
 - Map TMCS functions to system hardware;
 - TMCS functionality;
 - State of flight and/or flight plan life cycle;
 - Operator Roles;
 - All operator HMI;
 - System monitoring for verification of serviceability and system control as required for system maintenance;
 - TMCS system start up and recovery procedures which are included: NAS IBS switchover to NAS MOPS, APP IBS switchover to any APPS and CON/TRA contingency mode switchover to training mode and vice versa;
 - Line Replaceable Unit (LRU) maintenance and hardware replacement procedures;
 - Hardware configuration such as time server, routers, switches;
 - Operating system and application software installation; and
 - TMCS system troubleshooting.
- b) Intermediate level training for surveillance engineer staffs will include at least the following:
- Operating system administrative;
 - TMCS system administrative;
 - In-depth work process of TMCS software component and intersystem connection;
 - TMCS's standard and non-standard protocols;

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- ICDs such as ASTERIX, AIDC;
- In-depth work process of AIDC;
- In-depth work process of Air – Ground/ Ground – Ground data link communication;
- System parameter / system configuration of TMCS;
- Log and traces files analysis with the purpose of investigate/analyze problem and recover TMCS;
- Surveillance data analysis tools;
- Surveillance data input/output configuration/reconfiguration; and
- Other special tools and test equipment such as ASTERIX test tool.

The factory maintenance training will cover at least software training, and hardware training.

3.7.1 Software training

Detailed courses on the overall software system, as well as individual software package will be provided.

The training will include the use of software keys and tools needed to access and maintain all the programmes.

The training will cover an overview of the Data Management System and the basic knowledge in preparing, installing and updating the technical adaptation data.

Upon completion of this training, AEROTHAI's engineer personnel will be fully trained with complete knowledge of fault diagnosis and maintenance of the software.

3.7.2 Hardware training

The hardware training will be designed to train participants to be fully conversant with the system hardware, and to be equipped with the necessary knowledge and skill required to effectively maintain the System. The hardware training will at least include the following.

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The training will include a general appreciation of the overall system and its operation.

Comprehensive training will be provided in the techniques of troubleshooting, fault diagnosis, and remedial and routine preventive maintenance.

The training will include classroom instructions on theory as well as practical training using the Seller's equipment/system similar to the one to be delivered under the Contract.

3.8 Local Maintenance Training

The Seller will provide On-The-Job training at AEROTHAI office and AEROTHAI will be in charge of providing classrooms with similar facilities, a whiteboard, projector, and common stationery.

The training will include classroom instructions on theory as well as practical training using the AEROTHAI equipment/System.

3.9 Database Management System for Technical Training

Data Management System (DMS) for Technical Training will be conducted at the Factory. DMS will be provided, at least, two (2) surveillance engineer staffs to train them as Database Management System (DMS) specialist staff.

The course will achieve the following objectives:

- a) The DMS Technical Training will be designed to make surveillance engineer staffs understanding in the DMS logic, architecture and work process;
- b) The DMS Technical Training will be designed to make surveillance engineer staffs understanding in all dataset/system parameter/ system configuration of Main Operation System (MOPS), Contingency/Training System (CON/TRA) Independent Backup System (IBS) and Tower System;
- c) The DMS Technical Training will be designed to train participants to be equipped with the necessary knowledge and skill required to customize the System for local environment, maintain and update the site adaptation data, preparation and generation of adaptation database, etc.
- d) The DMS Technical Training will be designed to make surveillance engineer staffs able to manage Data System including the Data Preparation, adjust

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parameters according to their operational needs, and be autonomous to build from scratch a dataset. It will include integrated lectures and hands-on sessions that allow participants to enhance their knowledge on data management, and to practice the dataset building process.

3.10 Support for In-house Maintenance Training

Upon completion of the factory and local maintenance training, the Seller will deploy the competent and experienced technical instructor/trainer with skill and fully conversant with the System, to work with the trainers from AEROTHAI , to develop the future in-house maintenance training and refresher training which includes at least the following:

- Training structure;
- Training content;
- Training schedule;
- Training materials and documentation;
- Training facilities and equipment; and
- Training Assessment and Report.

3.11 Training Materials

The training materials will be provided to support each training course, including trainer guides, training manuals, notes, handouts, graph, diagram, workbooks, posters, video, etc., as necessary.

Twenty (20) complete sets of the training materials, both in hard copy and soft copy will be provided. AEROTHAI may make such further copies of the materials as are reasonably needed.

The training manuals for the technical training courses will cover detailed equipment description, system diagrams and circuit drawings, etc., as appropriate.

A complete set of training manual in hard copy for each operational and technical training course will be provided to each attendee of the corresponding training course.

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In addition to the training manual, comprehensive trainer guides in hard copy for each train the trainer training course will be provided to each attendee of the corresponding train the trainer training course.

All amendment of the training materials to reflect any updates or modifications will be supplied in softcopy full version format free of charge.

4 Documents

All documents and publications for the TMCS project are provided in English, which will be provided at least 6 (six) hard copy (paper) and CD-ROM (document format such as Adobe Acrobat, Microsoft word and Visio format).

The final edition of all documents and manuals should capture all the amendments up to the point of final acceptance and will reflect TMCS as handed over to AEROTHAI.

AEROTHAI has the right to a free license to copy the deliverable documentation called for under the contract, and to circulate or use the copies within the establishments of AEROTHAI.

4.1 Type of document

The various types of documents should be provided, but not limited to, as following:

- Global System / Segment Design Document which provides describe and specify the organization of Configuration Items corresponding to the design of TMCS and high level designed including interface requirements of TMCS and system integration;
- Global System / Segment Specification Document which provides describe and specify the top level requirements allocated to TMCS and also identify the external systems with which the supplied equipment must interface in order to archive the overall functionality required for TMCS;
- System / Segment Design Document which provides describe high-level design information of the TMCS, presents the organization of the TMCS such as Hardware Configuration Items (HWCI) and Computer Software configuration Items (CSCI), describes the allocation of system requirements to the HWCI and CSCI and also provides overview the functional capabilities of the system and provides a basis for performing system integration;

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- d) System / Segment Specification Document which provides describe in deep specify the technical requirements includes identify and describing function capabilities, performance characteristics ,the external system components to which the TMCS is interfaced and system capability relationships for describe functionality when some function failure occurs;
- e) Interface Control Documents (ICD) which provides describe the interface defines the exchange of messages between TMCS and external system and each segment/partition of TMCS, the ICD document will be stated which data items using for transmit , receive, restriction from standard;
- f) Hand book and/or user manual and/or reference manual which provides instructions for using TMCS as follows:
 - Data Base Management user manual and reference manual;
 - All HMI user manual;
 - NAS MOPS, NAS CON/TRA, NAS IBS, APPS, APP CON/TRA, APP IBS, LTS and RTS system user manual;
 - NAS MOPS, NAS CON/TRA,NAS IBS, APPS, APP CON/TRA, APP IBS, LTS and RTS system diagrams / wiring diagrams;
 - Control and Monitoring system user manual;
 - TMCS maintenance manual; and
 - Software install manual.

5 Spare parts

The number of spare for each type of workstations, servers and network equipment for TMCS will be not less than ten percent (10%) of the total number of that type of equipment.

These spare workstations, servers and network equipment will be preloaded with all necessary licensed software and suitably pre-configured to facilitate a prompt replacement of faulty equipment on site. All price shall be included in the Price Proposal.

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6 Special Tools and Test Equipment

The software tools, test equipment, and diagnostics/ test programs will be fully provided to achieve the standard of software and hardware maintenance, in particular, the repair of equipment down to component level.

A suite of tools for map drawing and creation will be provided.

The ASTERIX test tools are fully graphical user interface that will be provided with fully supporting all currently standardized ASTERIX radar data categories. It will be also allowed a sufficiently authorized user to define new ASTERIX categories as well as User Application Profile (UAPs) according to the specific requirements of an application.

All price shall be included in the Price Proposal.

SECTION C SUPPORT AND AFTER SALE SERVICE REQUIREMENTS

1 Service Life

- SER001 : The tenderer shall propose the service life of the proposed system and detail how the proposed system can be operated up to the end of service life . [D]
- SER002 : The tenderer shall propose the components that estimated service life is less than 15 years. [D]
- SER003 : The tenderer shall propose the solution to handle the components that estimated service life less than 15 years. [D]
- SER004 : The tenderer shall propose and detail the after sales support for the software of the system which includes details of that support. [D]

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2 Warranty

WAR001: The Tenderer shall propose the methodologies and Warranty Support Plan [D]
including warrantee period of TMCS hardware and software.

3 Training

TRA001:	The Tenderer shall propose and describe the Training program which includes course syllabus, objectives, pre-requisites, duration and approach for training personnel involved with the delivered equipment (both hardware and software)..	[D]
TRA002:	The Tenderer shall propose Database Management System Training course which includes number of attendances, venue, and contents.	[D]
TRA003:	The Tenderer shall propose Air Traffic Control Operational Train the Trainer Training course which includes number of attendances, venue, and contents.	[D]
TRA004:	The Tenderer shall propose Flight Data Operator Train the Trainer Training course which includes number of attendances, venue, and contents.	[D]
TRA005:	The Tenderer shall propose Training Supervisor/Instructor Training course which includes number of attendances, venue, and contents.	[D]
TRA006:	The Tenderer shall propose TRA Pseudo-pilot Training course which includes number of attendances, venue, and contents.	[D]
TRA007:	The Tenderer shall propose Factory Maintenance Training course which includes number of attendances, venue, and contents.	[D]
TRA008:	The Tenderer shall propose Local Maintenance Training course which includes number of attendances, venue, and contents.	[D]
TRA009:	The Tenderer shall propose Data Management System Technical Training course which includes number of attendances, venue, and contents.	[D]

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- TRA010: The Tenderer shall propose and describe the support to develop the training and refresher training course for future in-house maintenance training. [D]
- TRA011: The Tenderer shall propose the list of training materials that will be provided for all training courses. [D]

4 Documents

- DOC001: The Tenderer shall provide the list of delivery document of the TMCS project including detail of document (such as number of document, language, document format). [D]

5 Spare parts

- SPA001: The Tenderer shall propose the scope of supply of spare parts for TMCS. [D]

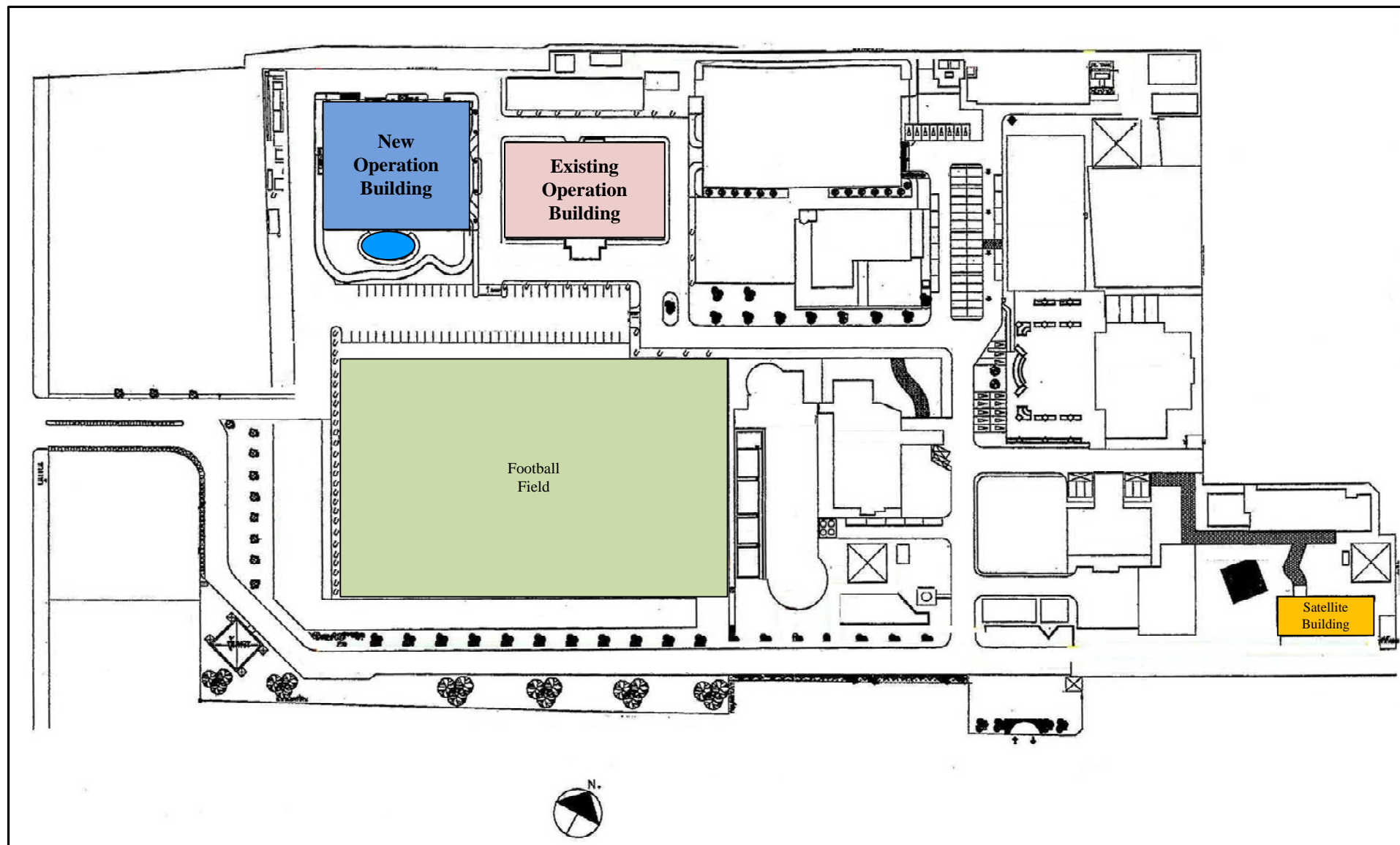
6 Special Tools and Test Equipment

- TAT001: The Tenderer shall propose the scope of supply of tools and test equipments for TMCS that will be provided for software and hardware maintenance, including but not limited to software tools and ASTERIX test tools. [D]

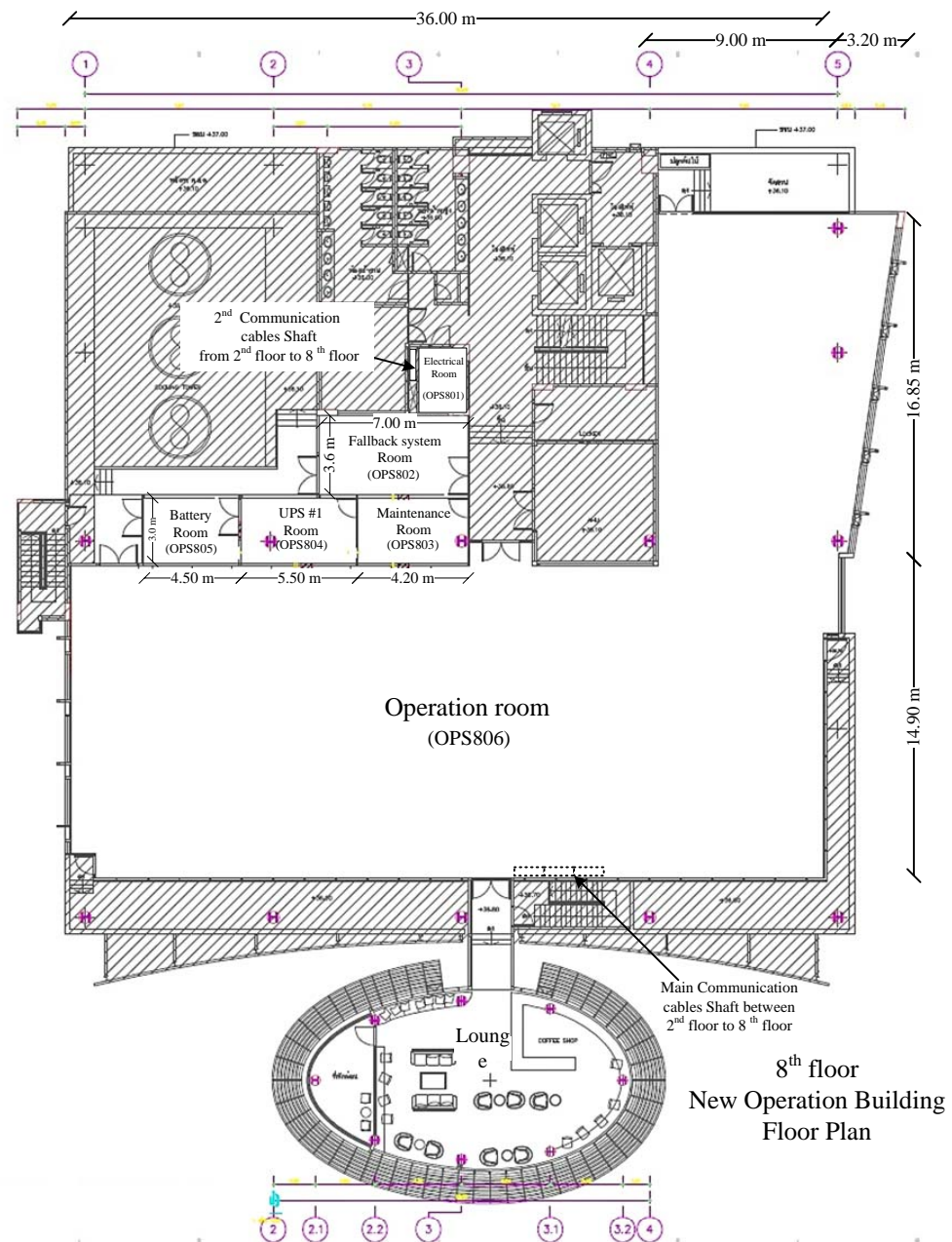
1 Attachments for Site Information

1. Attachment 6.1.1 The location of New Operation Building and Existing Operation Buildings at Tungmahamek Site
2. Attachment 6.1.1a The location of the Operation Room, Fallback System Room and UPS #2 Room of NAS MOPS
3. Attachment 6.1.1b The location of the Pre-tactical Operation Room of NAS MOPS
4. Attachment 6.1.1c The location of Equipment Room of NAS MOPS
5. Attachment 6.1.1d The location of CON/TRA Room of NAS CON/TRA
6. Attachment 6.1.1e The location of CON/TRA Room of NAS CON/TRA
7. Attachment 6.1.2a The location of the Operation Room, CON/TRA Room, Equipment Room and Local Tower Control Room of CMA APP MOPS, CMA APP CON/TRA and CMA LTS
8. Attachment 6.1.2b The location of the UPS Room
9. Attachment 6.1.3 The location of HTY APC Building and Training Building at Hat Yai Site
10. Attachment 6.1.3a The location of the Operation Room, Equipment Room and Local Tower Control Room of HTY APP MOPS and HTY LTS
11. Attachment 6.1.3b The location of the CON/TRA Room, Pilot Room and Equipment Room of HTY APP CON/TRA
12. Attachment 6.1.4 The location of PUT APC Buildings and Administrative Building at Phuket Site.
13. Attachment 6.1.4a The location of the Operation Room, Equipment Room and Local Tower Control Room of PUT APP MOPS and PUT LTS
14. Attachment 6.1.4b The location of the CON/TRA Room, Pilot Room and Equipment Room of PUT APP CON/TRA
15. Attachment 6.1.4c The location of the UPS Room of PUT APP CON/TRA
16. Attachment 6.1.5 The location of PSL APC Building and Administrative Building at Phitsanulok Site
17. Attachment 6.1.5a The location of the Operation Room, Equipment Room and Local Tower Control Room of PSL APP MOPS and PSL LTS
18. Attachment 6.1.5b The location of the CON/TRA Room, Pilot Room and Equipment Room of PSL APP CON/TRA
19. Attachment 6.1.5c The location of the UPS Room of PSL APP CON/TRA
20. Attachment 6.1.6 The location of HHN APC Building and Air Field Lighting Building at Hua Hin Site

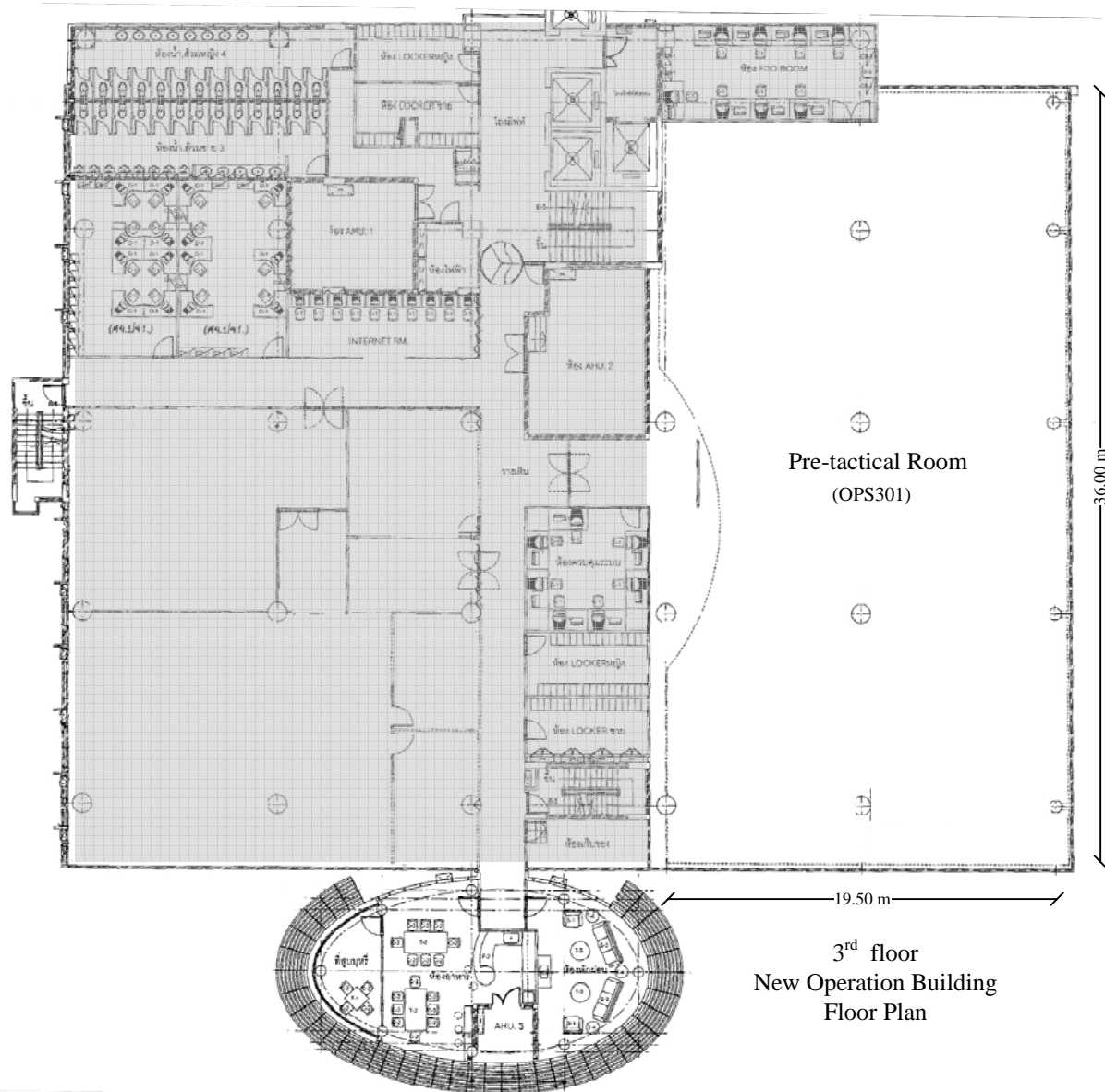
21. Attachment 6.1.6a The location of the Operation Room and Local Tower Control Room of HHN APP MOPS and HHN LTS
22. Attachment 6.1.6b The location of the Equipment Room of HHN APP MOPS and HHN LTS
23. Attachment 6.1.6c The location of the CON/TRA Room, of HHN APP CON/TRA
24. Attachment 6.1.7 The location of ATC Support Building, SBA Tower Building and Emergency Buildings at Suvarnabhumi Airport Site
25. Attachment 6.1.7a The location of the Operation Room of BAPP MOPS
26. Attachment 6.1.7b The location of the Equipment Room of BAPP MOPS
27. Attachment 6.1.7c The location of the Operation Room, Equipment Room and Local Control Room of SBA LTS
28. Attachment 6.1.3d The location of the CON/TRA Room, Pilot Room and Equipment Room of BAPP CON/TRA
29. Attachment 6.1.7e The location of the UPS#1 Room, UPS#2 Room and UPS#3 at Suvarnabhumi Airport Site



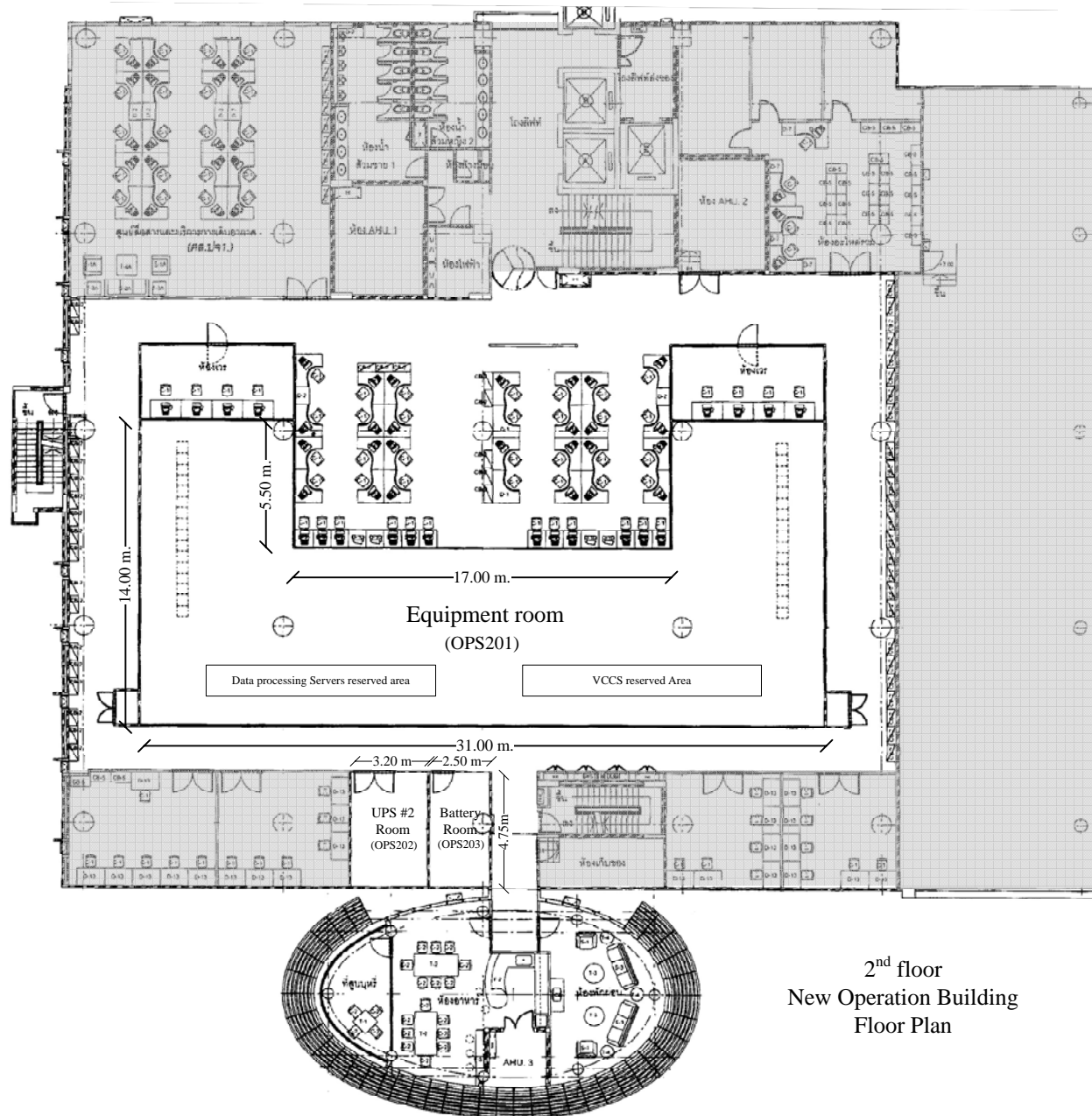
Attachment 6.1.1 The location of New Operation Building and Existing Operation Buildings at Tungmahamek Site



Attachment 6.1.1a The location of the Operation Room, Fallback System Room and UPS #2 Room of NAS MOPS

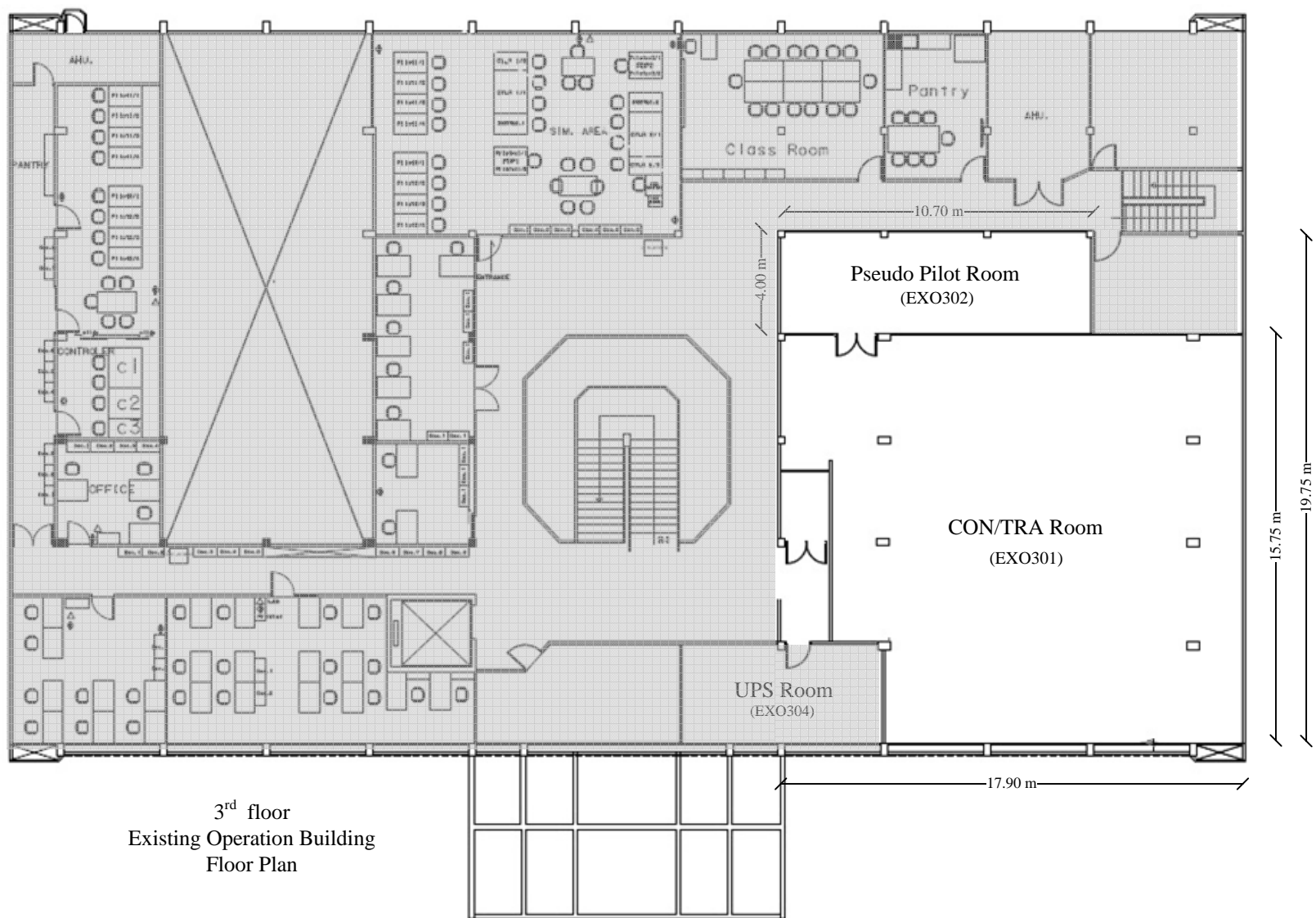


Attachment 6.1.1b The location of the Pre-tactical Operation Room of NAS MOPS

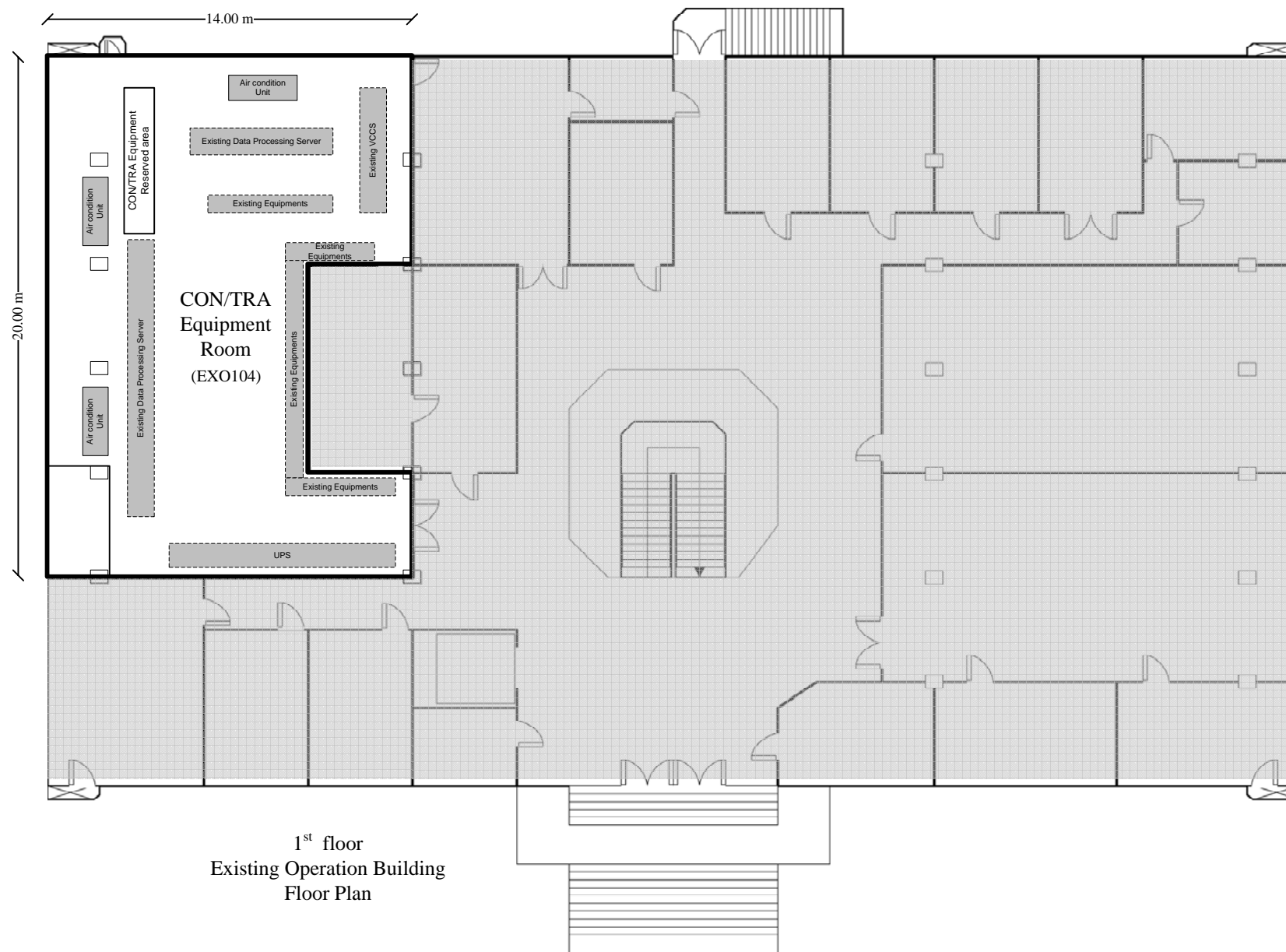


2nd floor
New Operation Building
Floor Plan

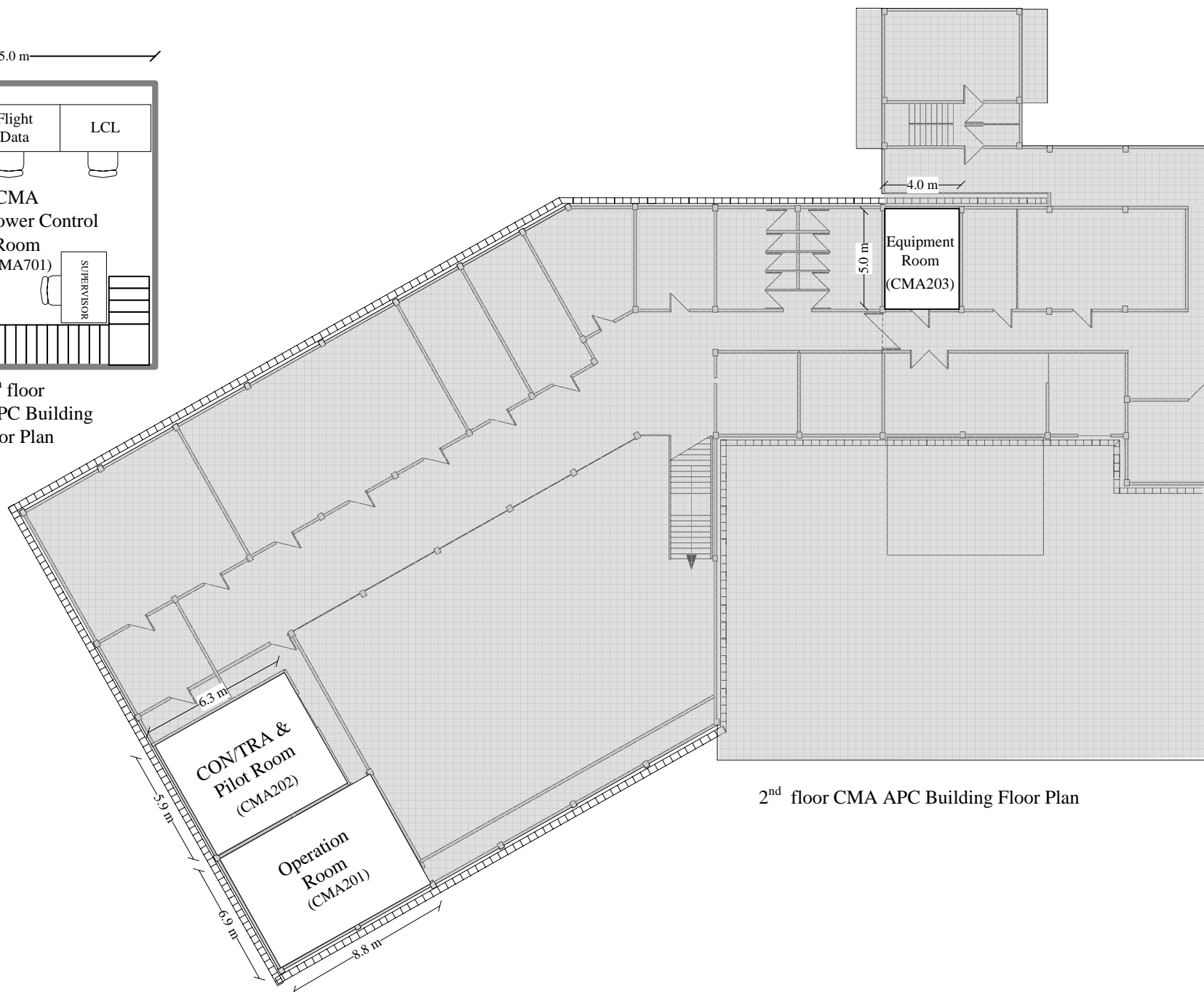
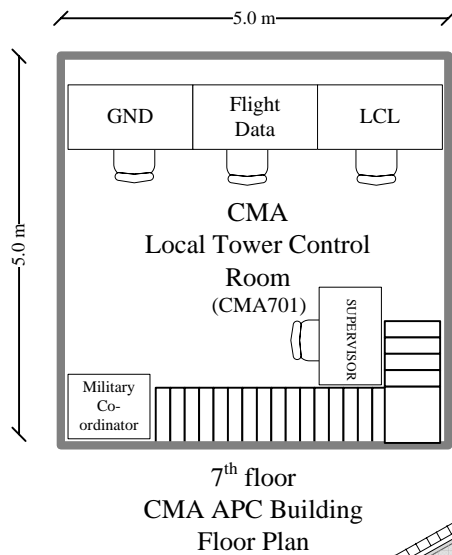
Attachment 6.1.1c The location of Equipment Room of NAS MOPS



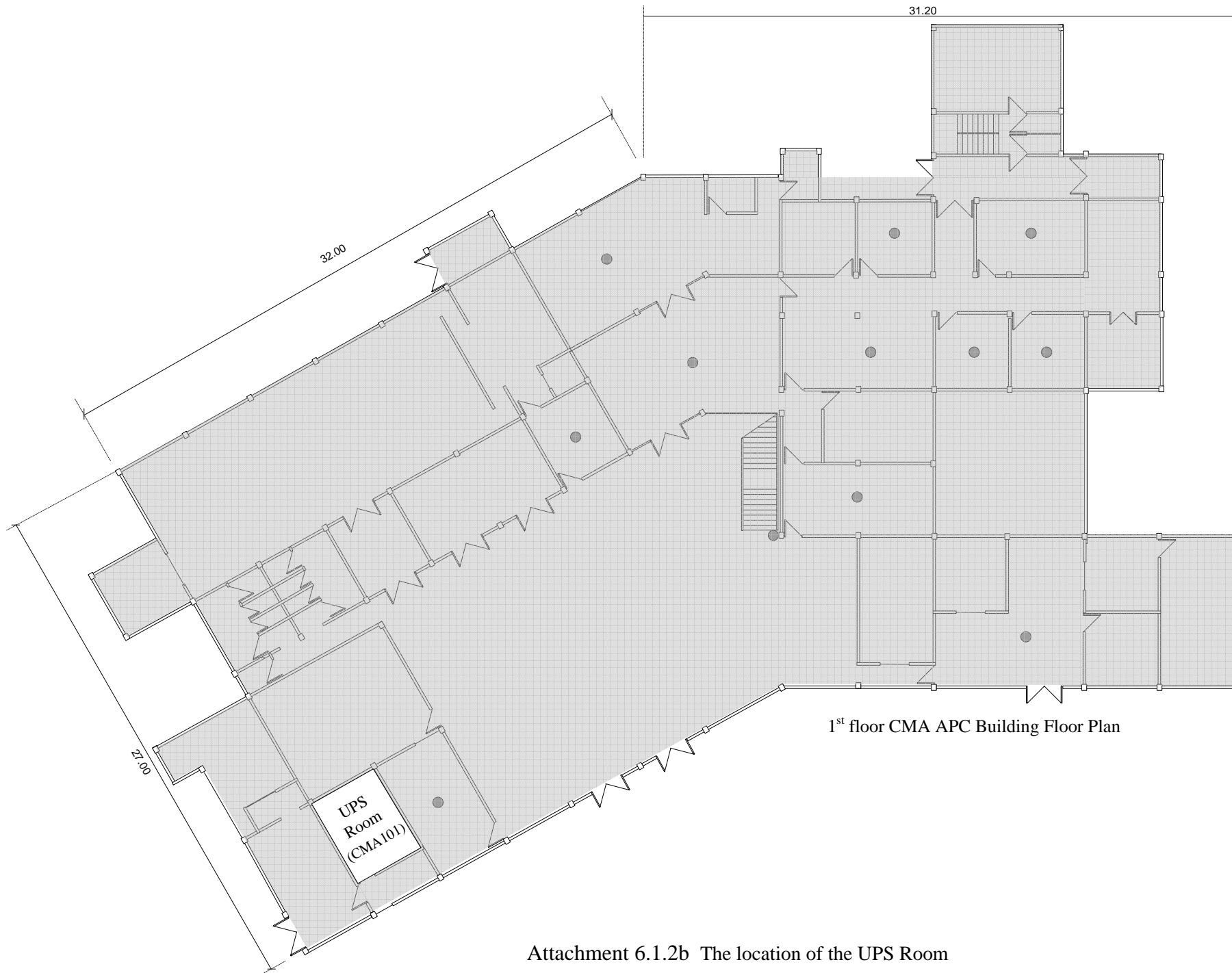
Attachment 6.1.1d The location of CON/TRA Room of NAS CON/TRA



Attachment 6.1.1e The location of CON/TRA Room of NAS CON/TRA



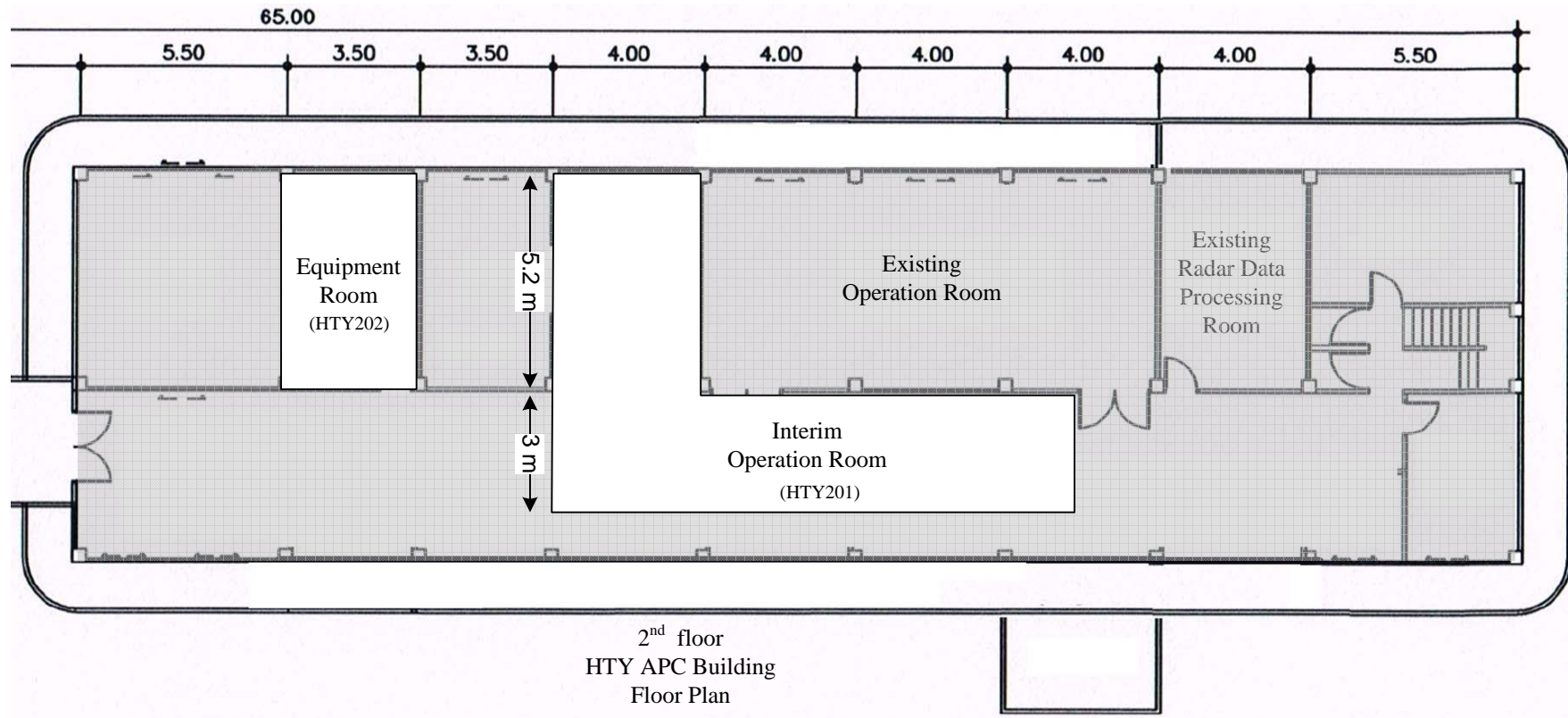
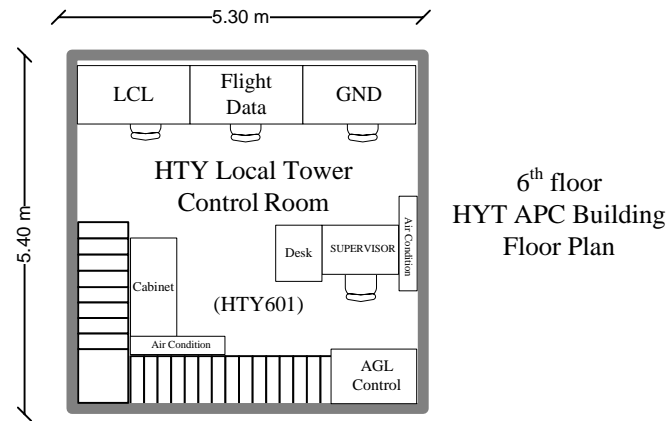
Attachment 6.1.2a The location of the Operation Room, CON/TRA Room, Equipment Room and Local Tower Control Room of CMA APP MOPS, CMA APP CON/TRA and CMA LTS



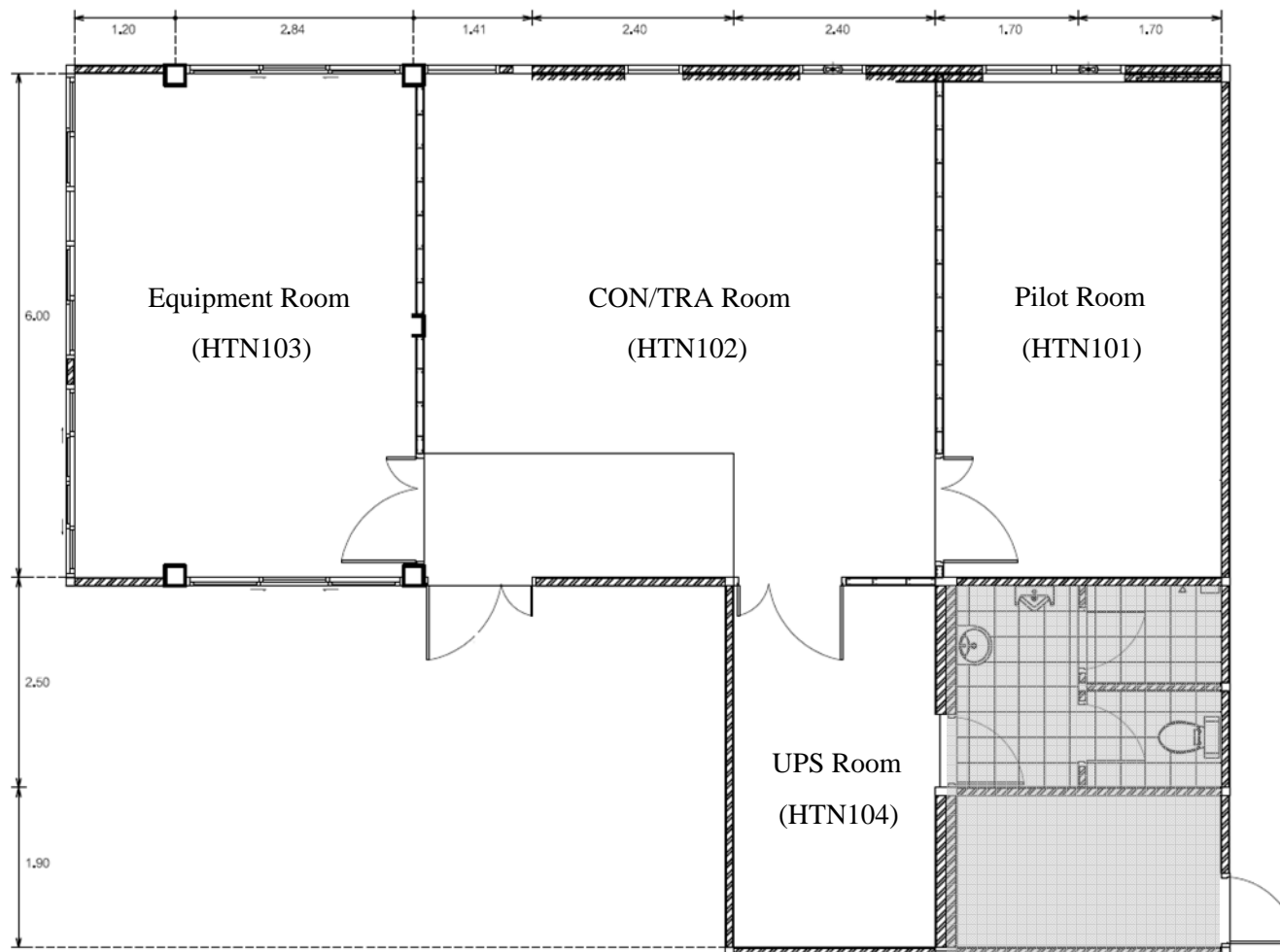
Attachment 6.1.2b The location of the UPS Room



Attachment 6.1.3 The location of HTY APC Building and Training Building at Hat Yai Site

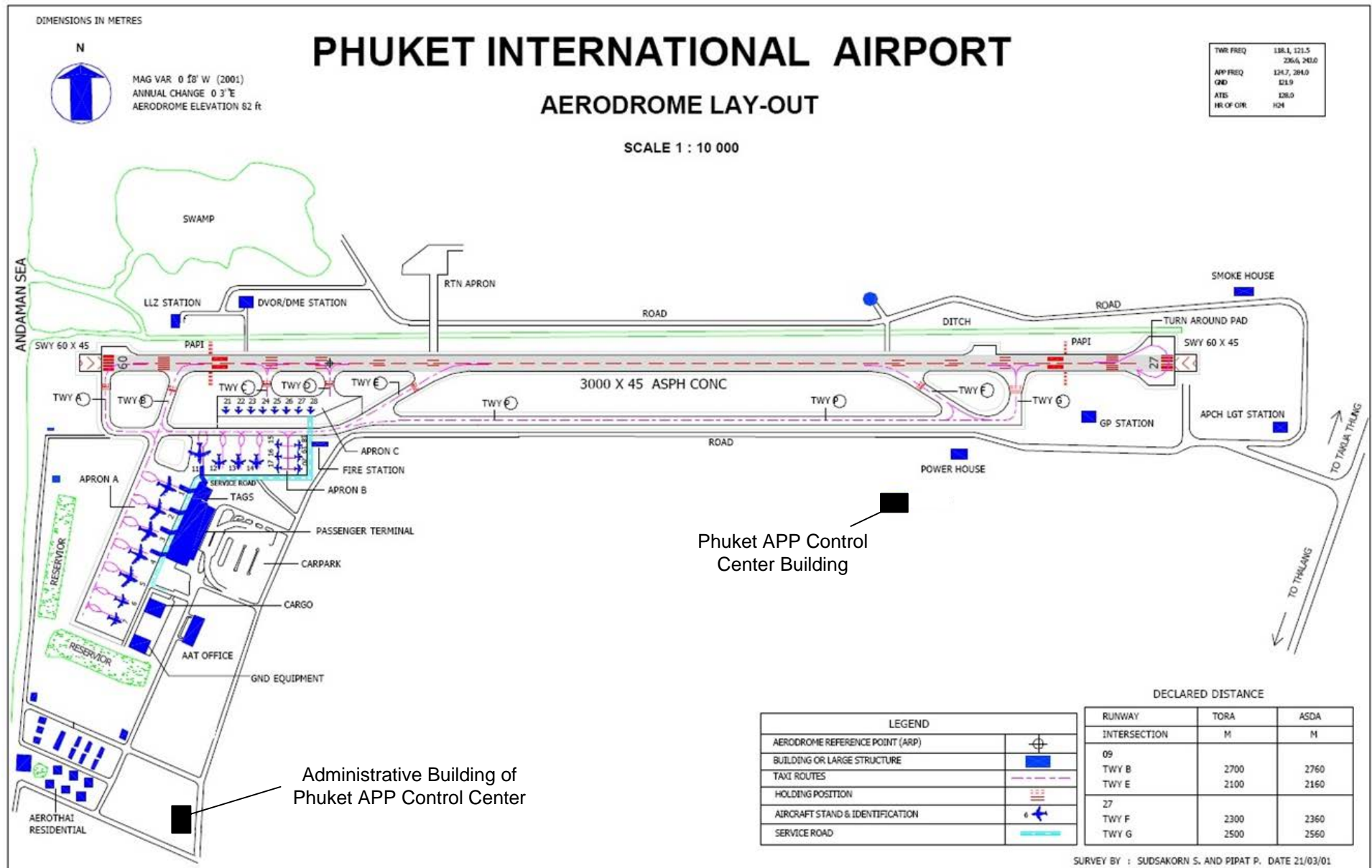


Attachment 6.1.3a The location of the Operation Room, Equipment Room and Local Tower Control Room of HTY APP MOPS and HTY LTS

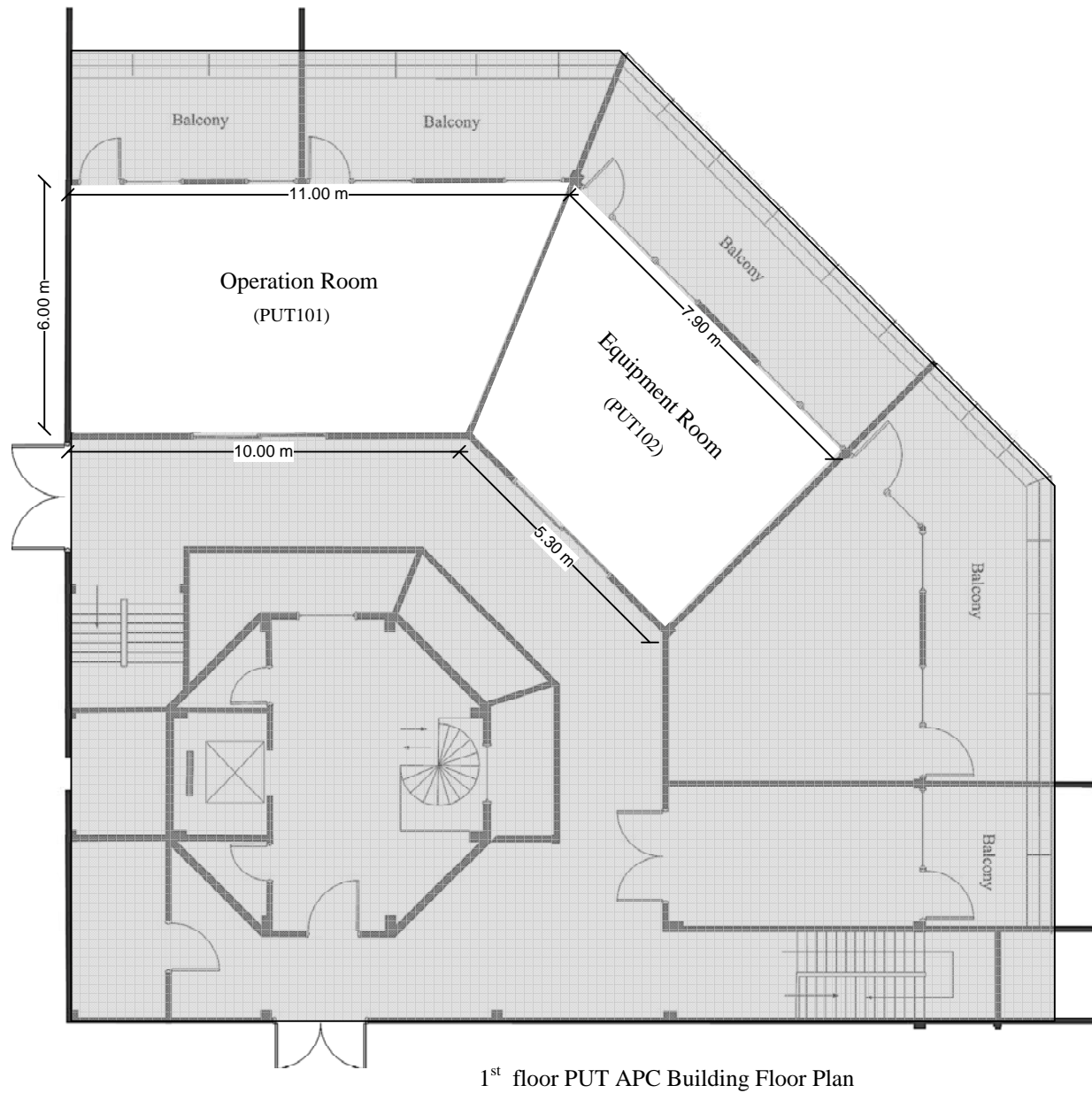
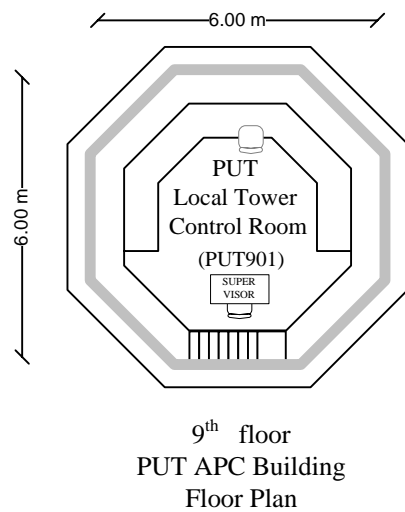


1st floor HTY Training Building Floor Plan

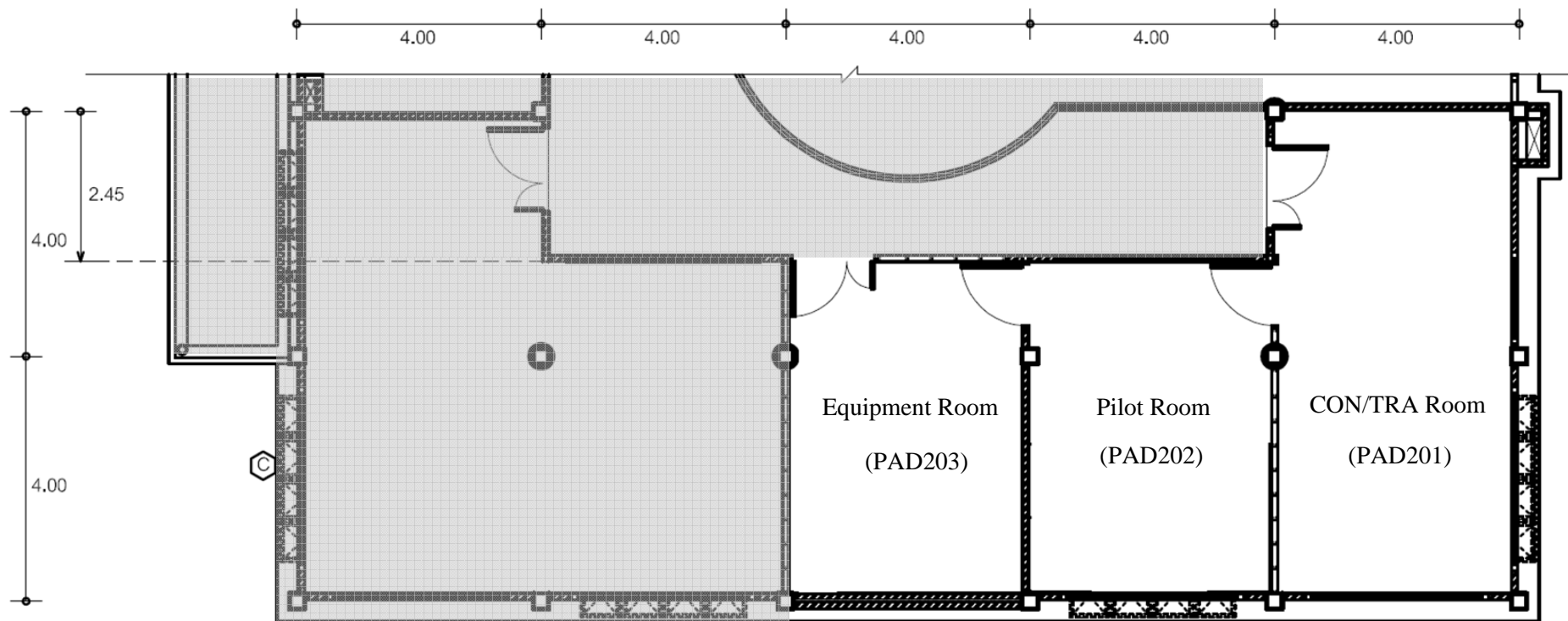
Attachment 6.1.3b The location of the CON/TRA Room, Pilot Room and Equipment Room of HTY APP CON/TRA



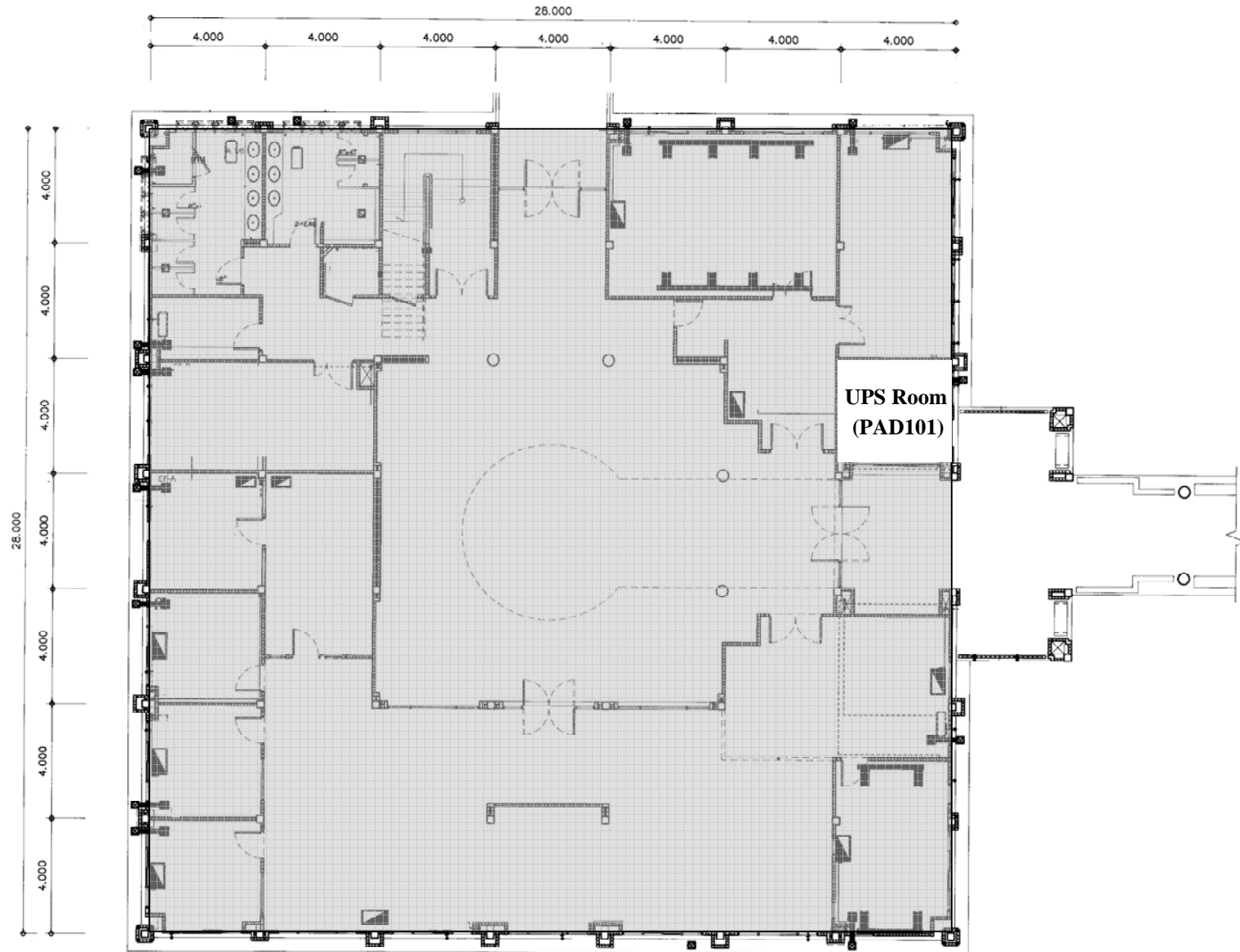
Attachment 6.1.4 The location of PUT APC Buildings and Administrative Building at Phuket Site.



Attachment 6.1.4a The location of the Operation Room, Equipment Room and Local Tower Control Room of PUT APP MOPS and PUT LTS

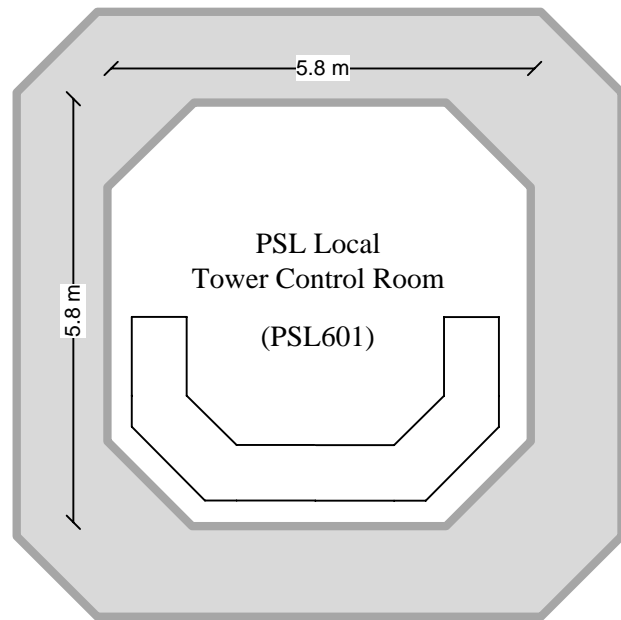


2nd floor PUT Administrative Building Floor Plan

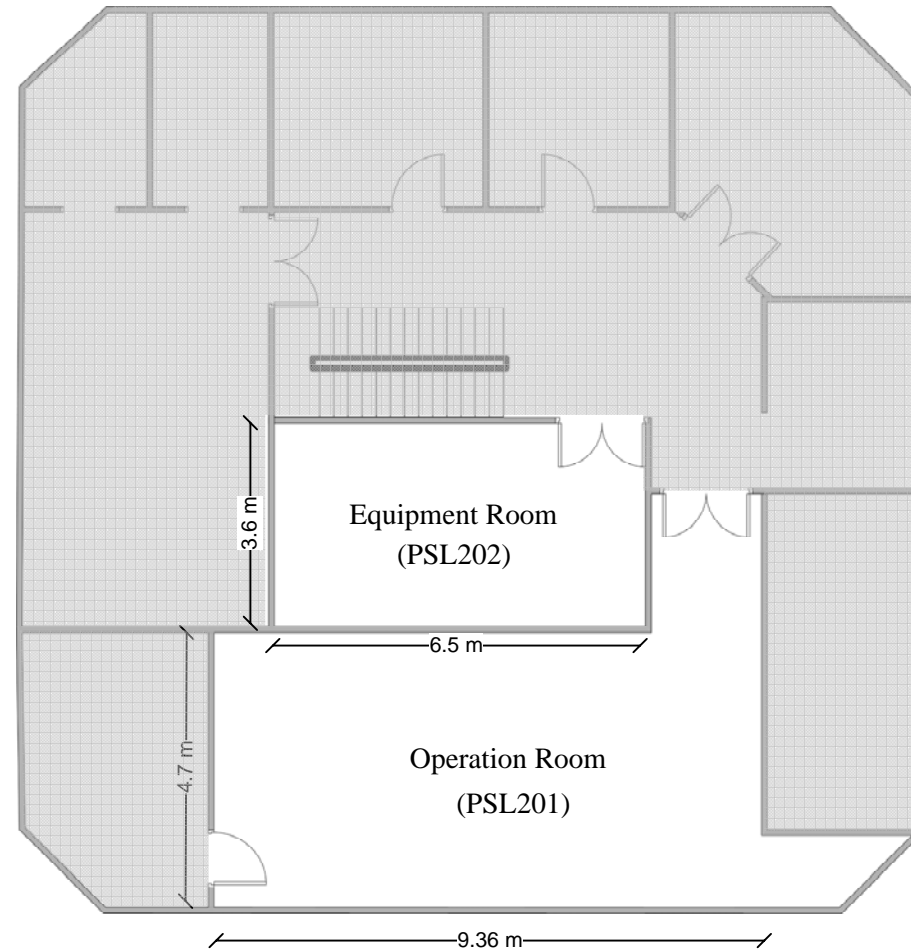


1st floor PUT Administrative Building Floor Plan

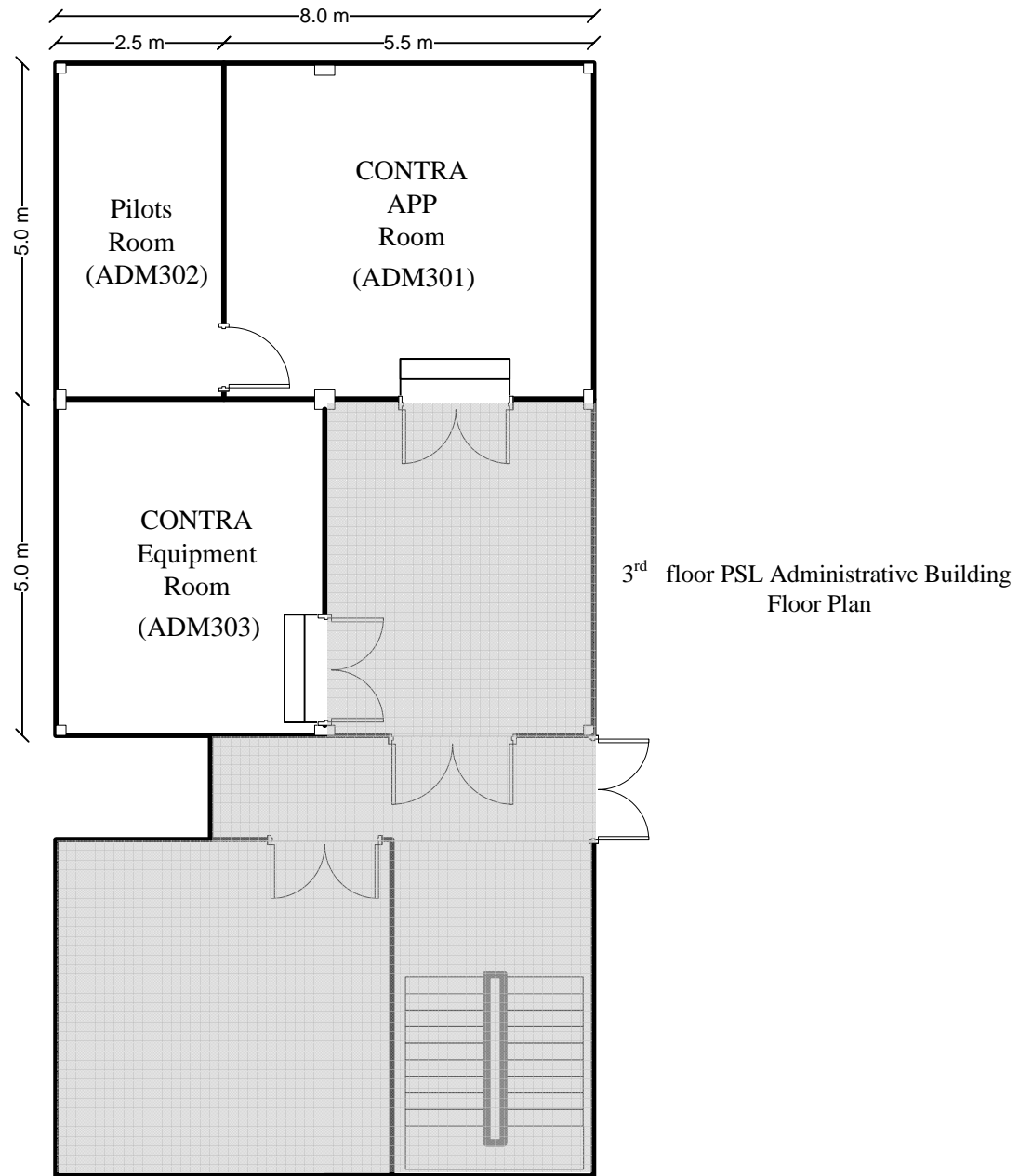
Attachment 6.1.4c The location of the UPS Room of PUT APP CON/TRA



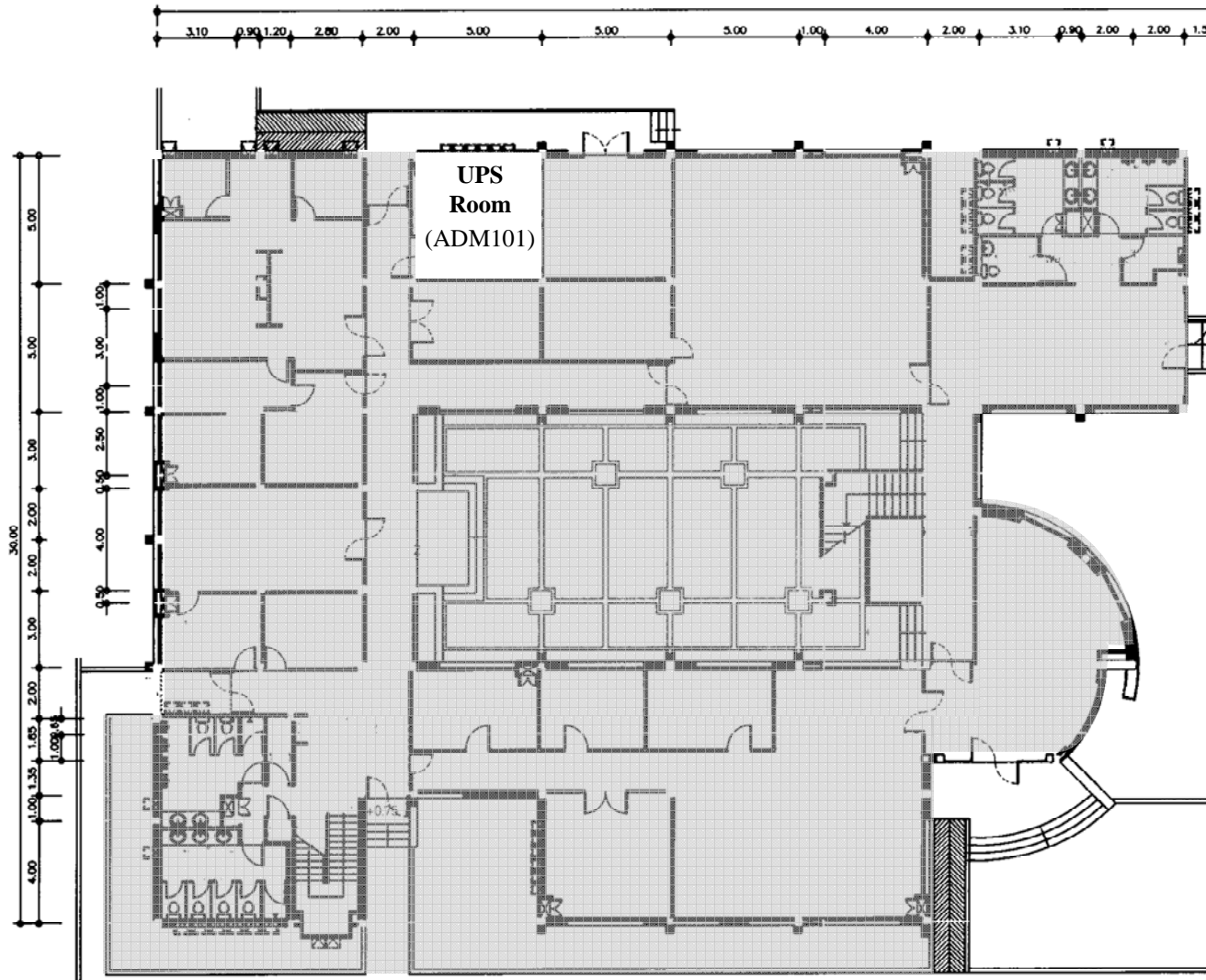
6th floor PSL APC Building Floor Plan



2nd floor PSL APC Building Floor Plan

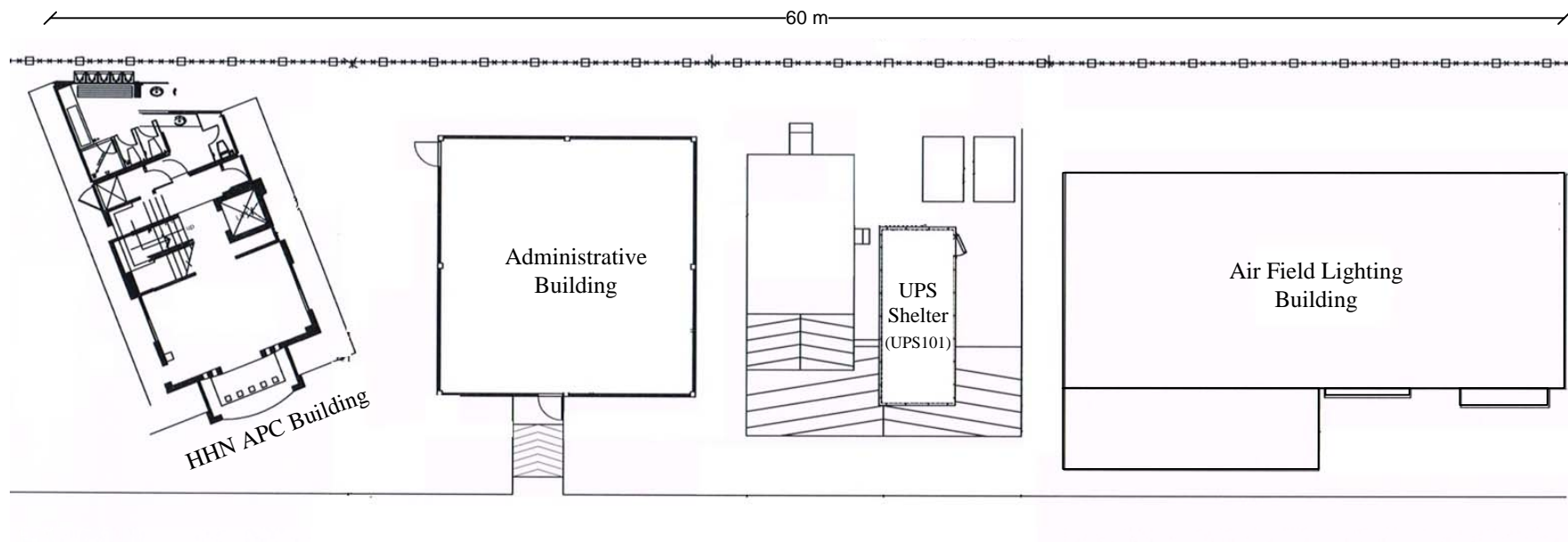


Attachment 6.1.5b The location of the CON/TRA Room, Pilot Room and Equipment Room of PSL APP CON/TRA

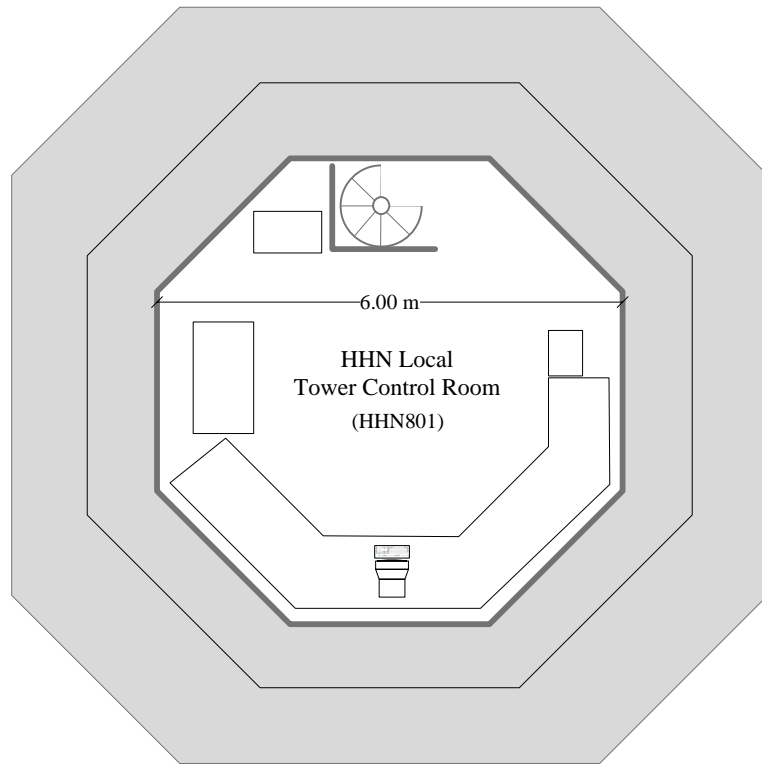


1st floor PSL Administrative Building Floor Plan

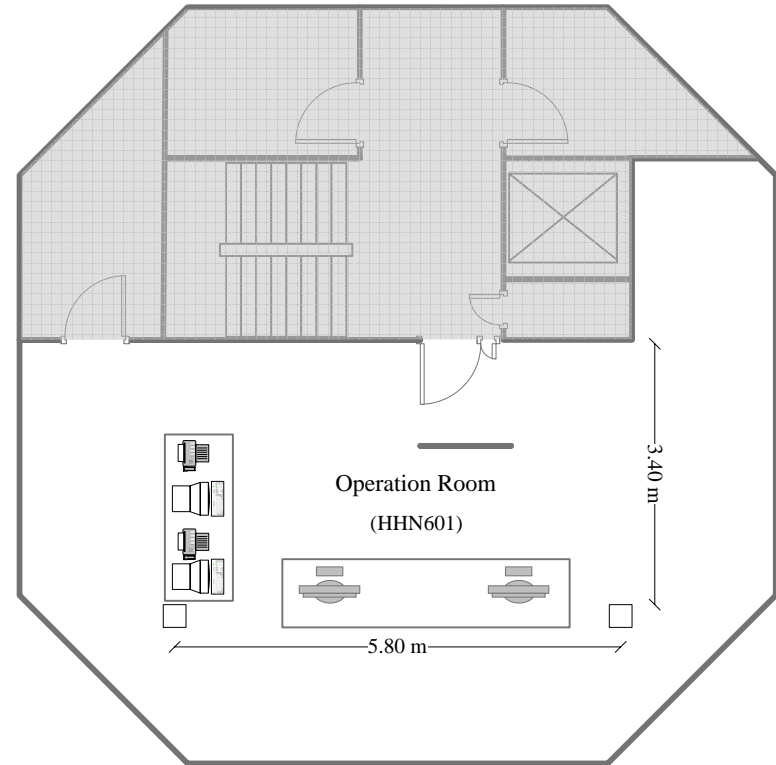
Attachment 6.1.5c The location of the UPS Room of PSL APP CON/TRA



Attachment 6.1.6 The location of HHN APC Building and Air Field Lighting Building at Hua Hin Site

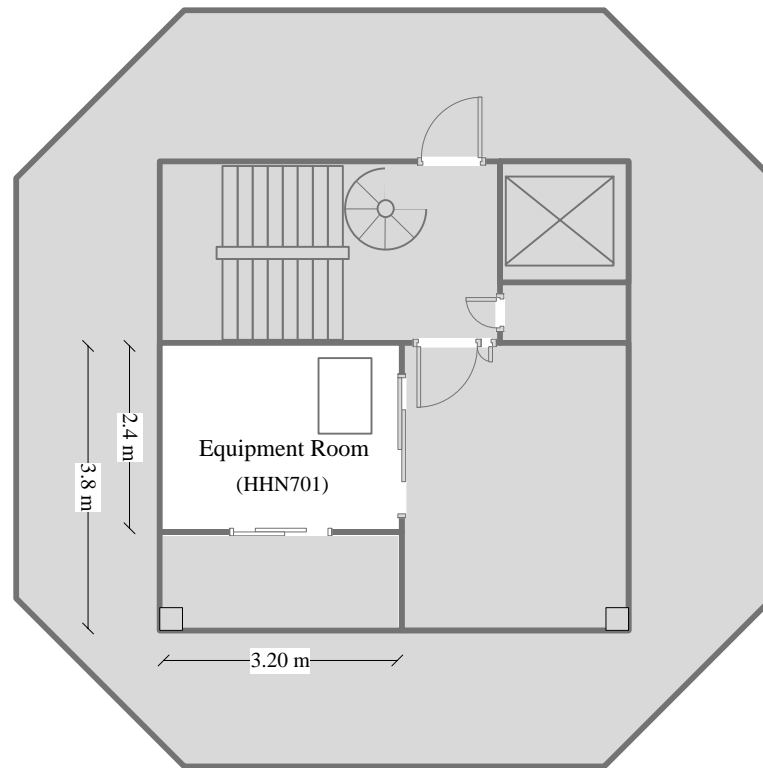


8th floor HHN APC Building Floor Plan



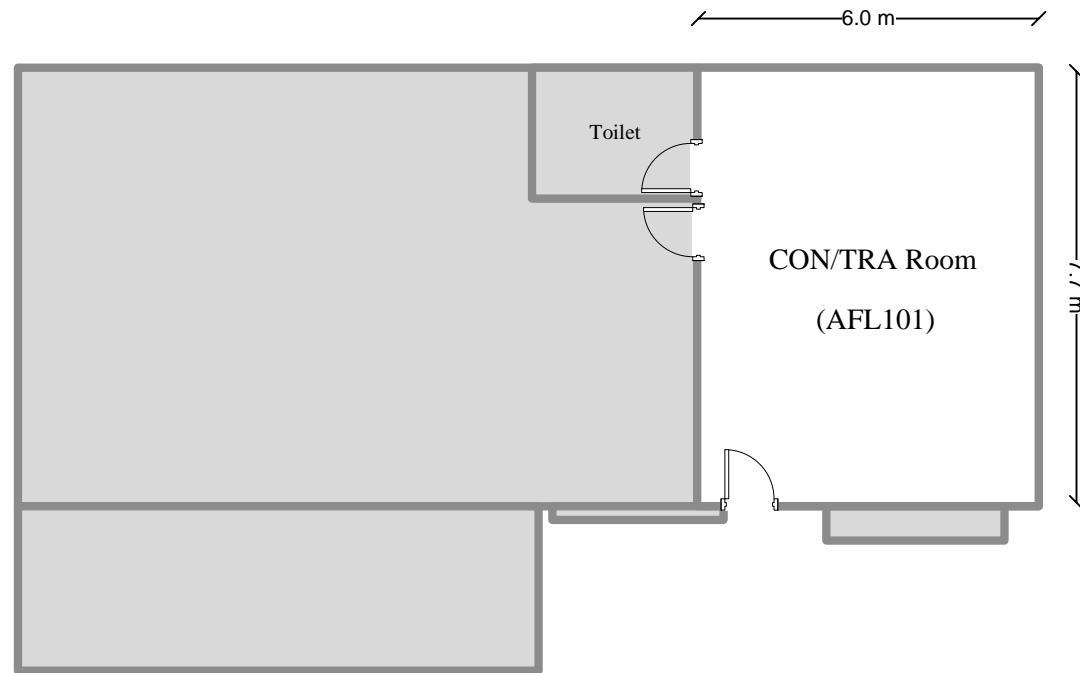
6th floor HHN APC Building Floor Plan

Attachment 6.1.6a The location of the Operation Room and Local Tower Control Room of
HHN APP MOPS and HHN LTS



7th floor HHN APC Building Floor Plan

Attachment 6.1.6b The location of the Equipment Room of HHN APP MOPS and HHN LTS



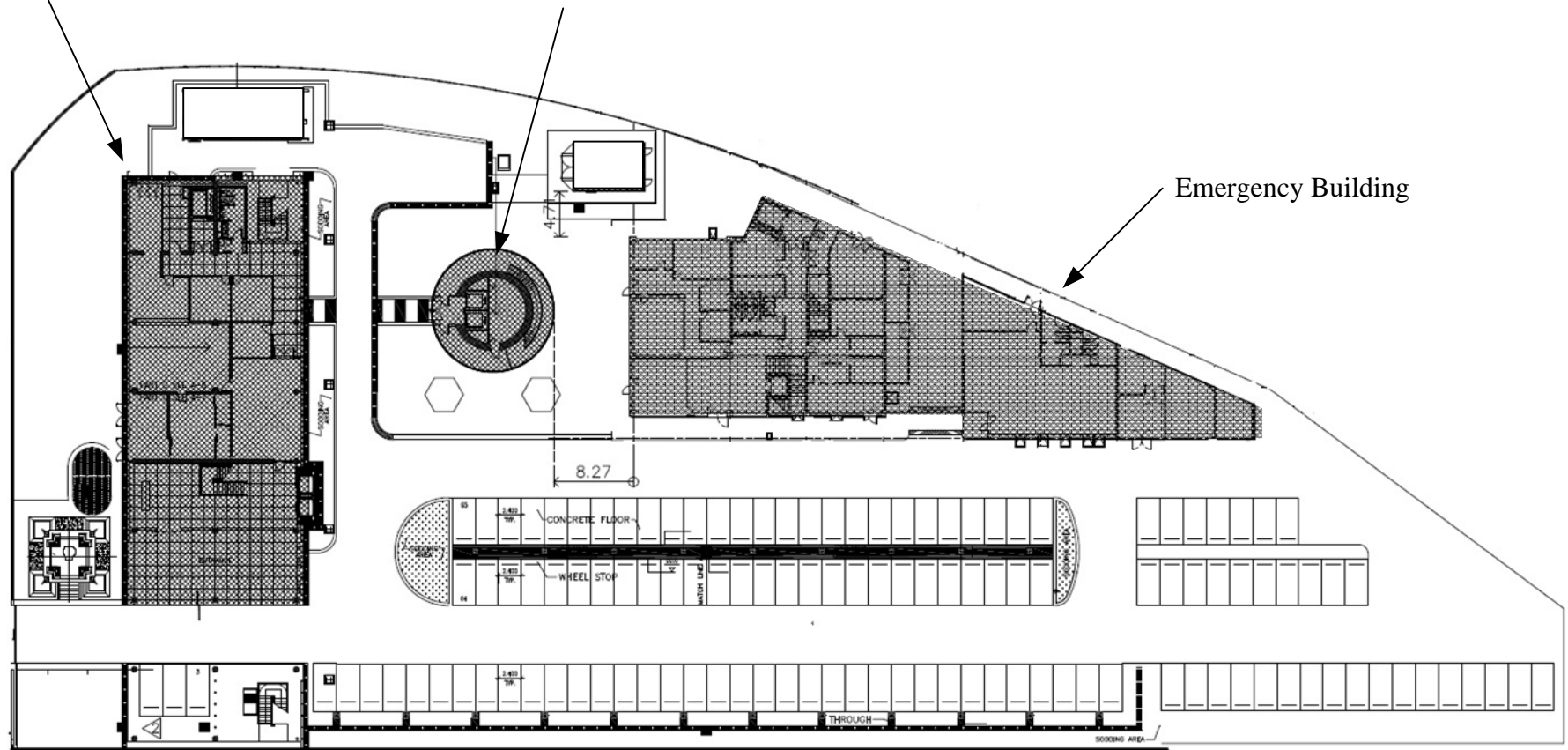
1st floor Air Field Lighting Building Floor Plan

Attachment 6.1.6c The location of the CON/TRA Room, of HHN APP CON/TRA

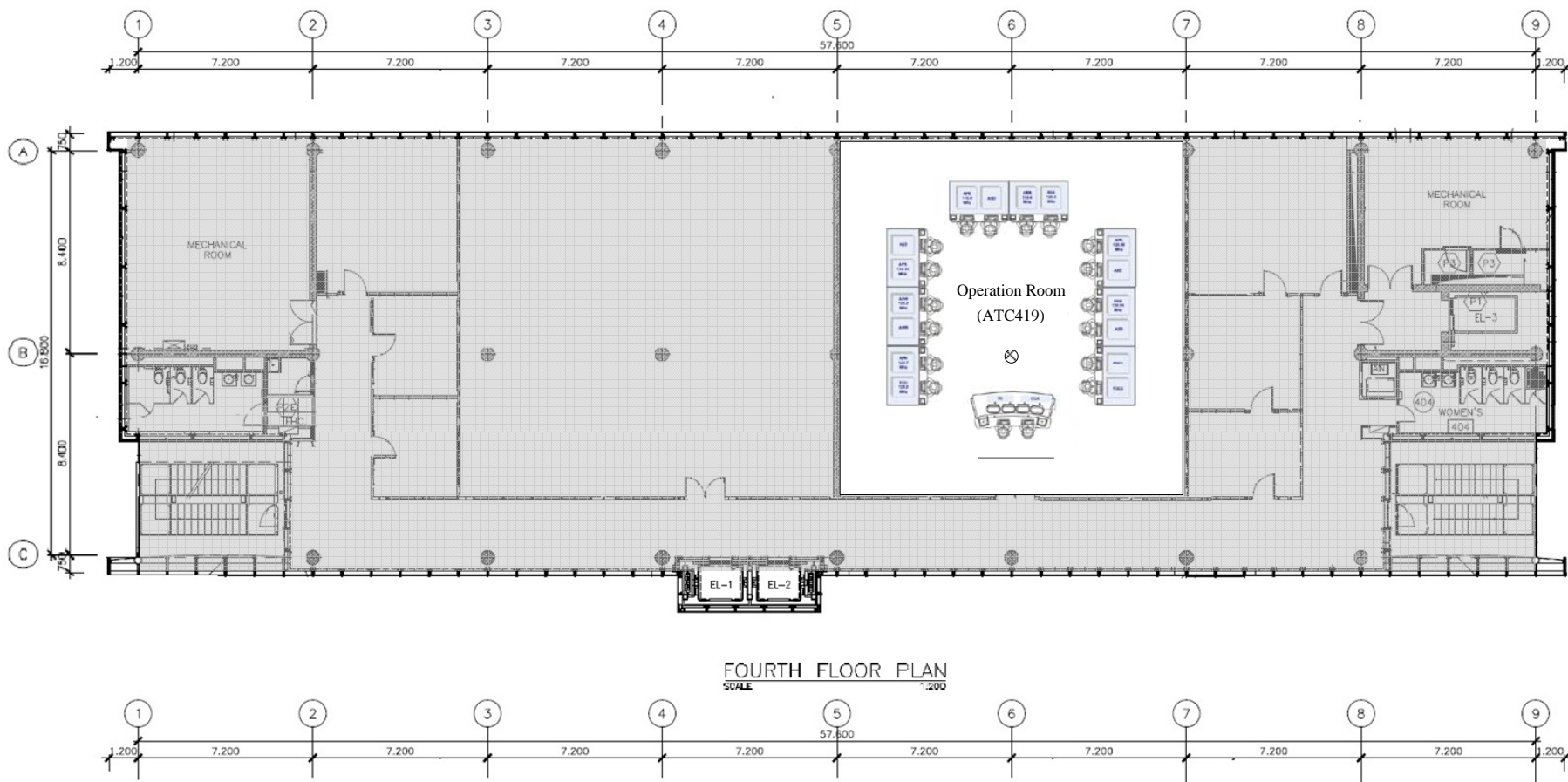
ATC Support Building

SBA Tower Building

Emergency Building

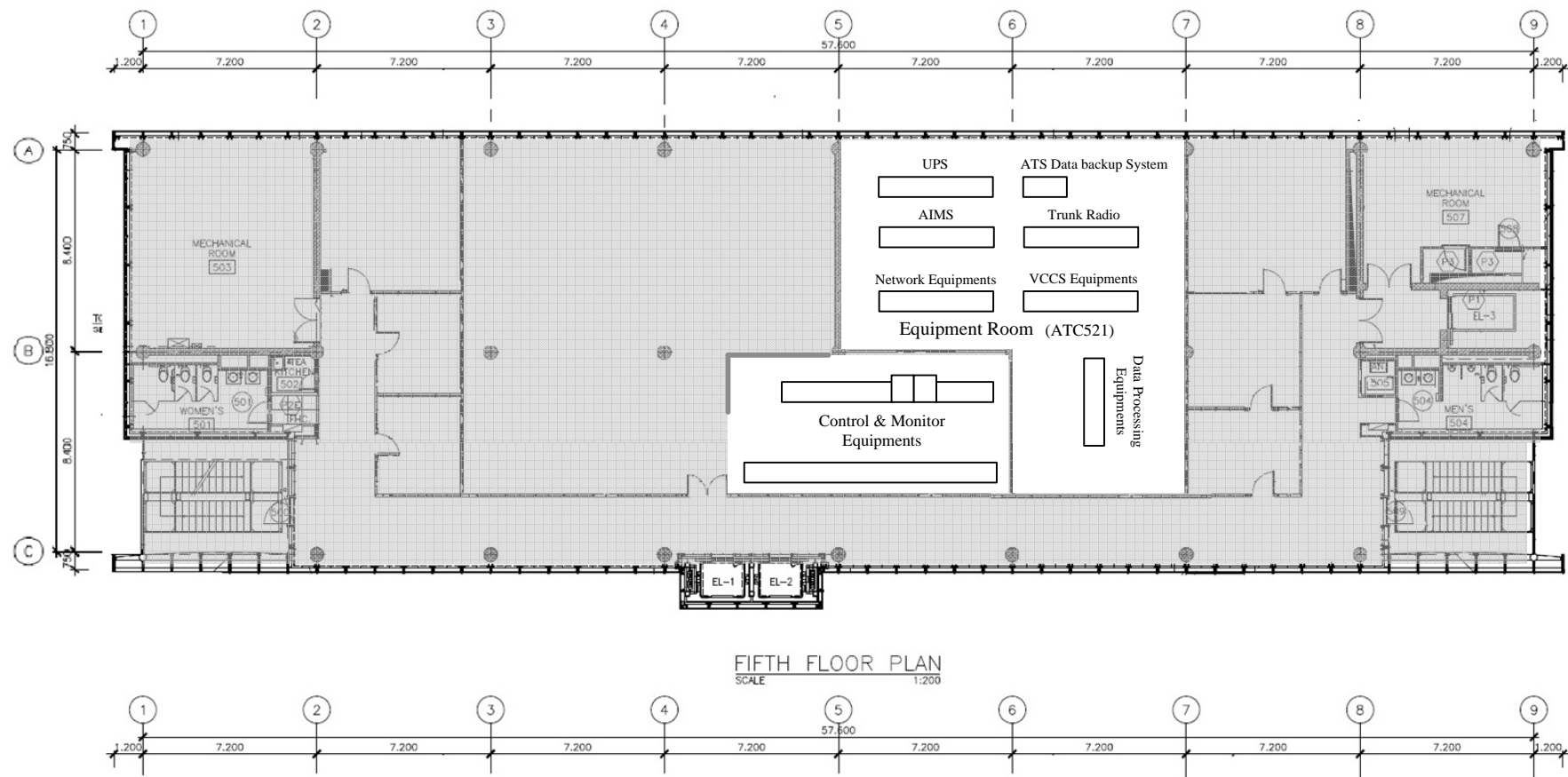


Attachment 6.1.7 The location of ATC Support Building, SBA Tower Building and Emergency Buildings at Suvarnabhumi Airport Site

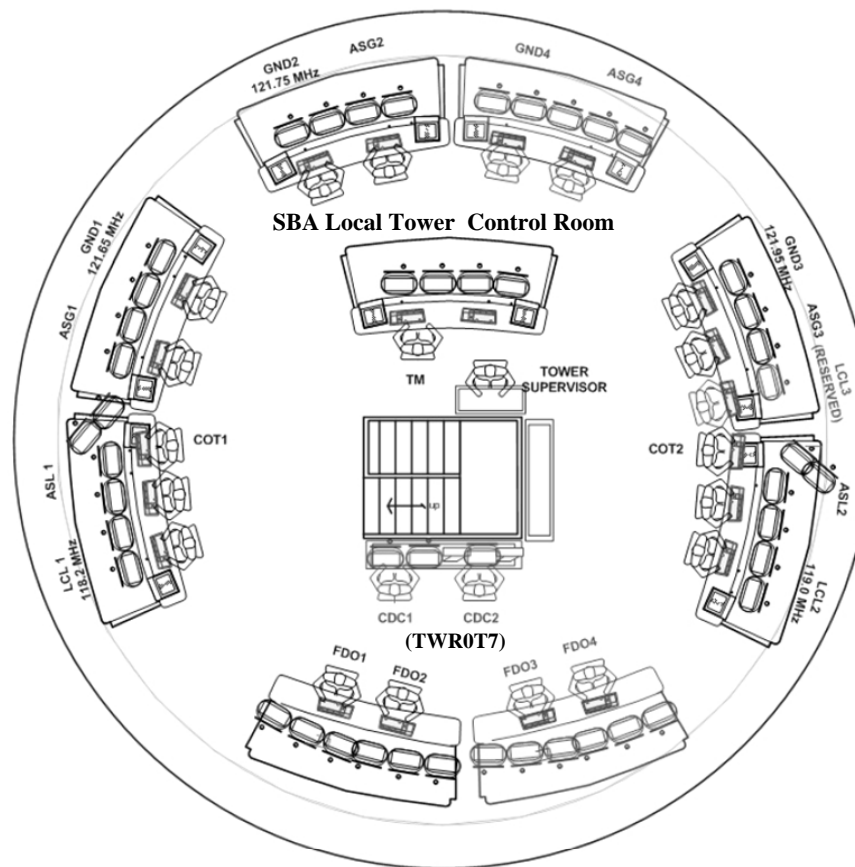


4th floor ATC Support Building Floor Plan

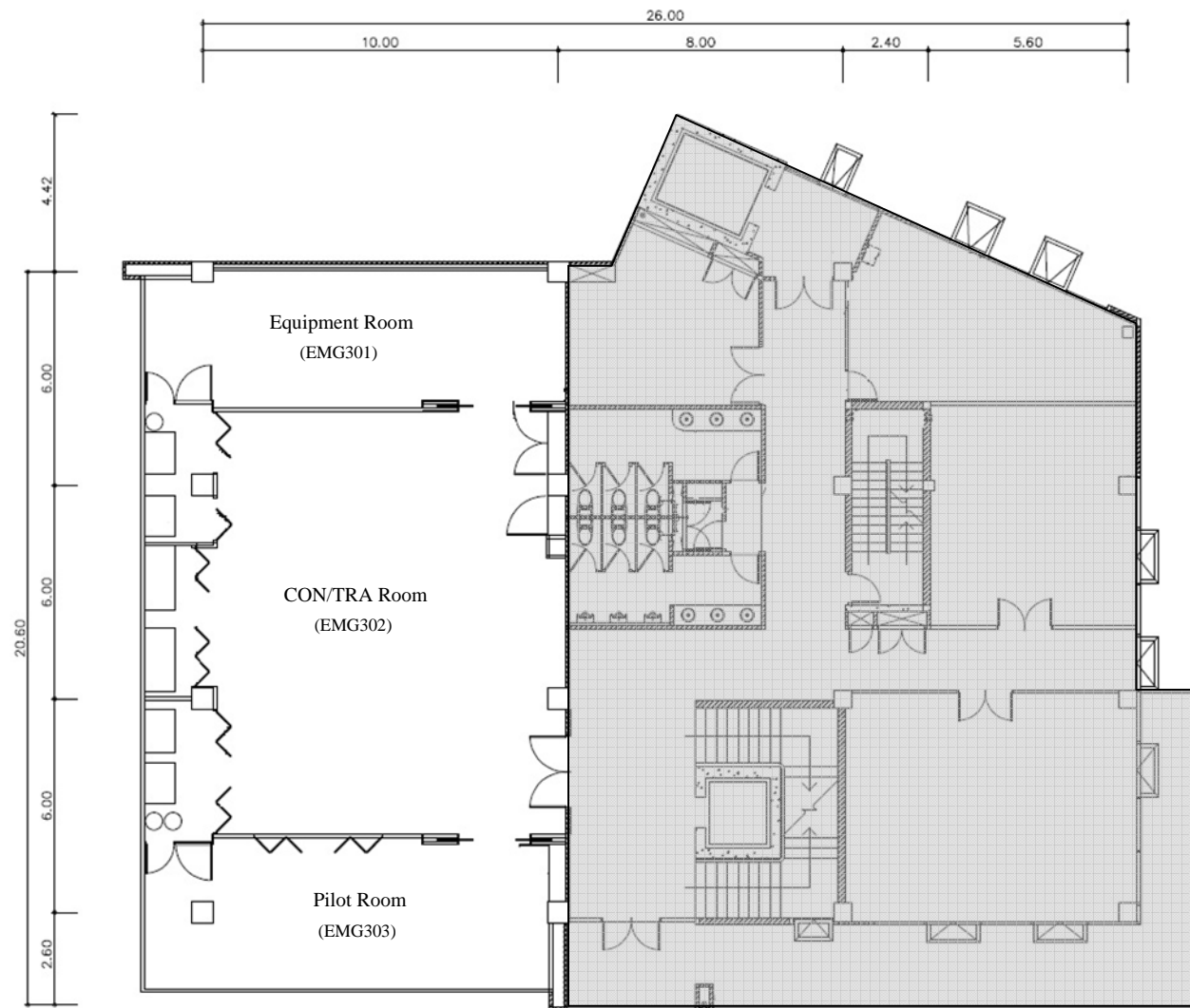
Attachment 6.1.7a The location of the Operation Room of BAPP MOPS



5th floor ATC Support Building Floor Plan

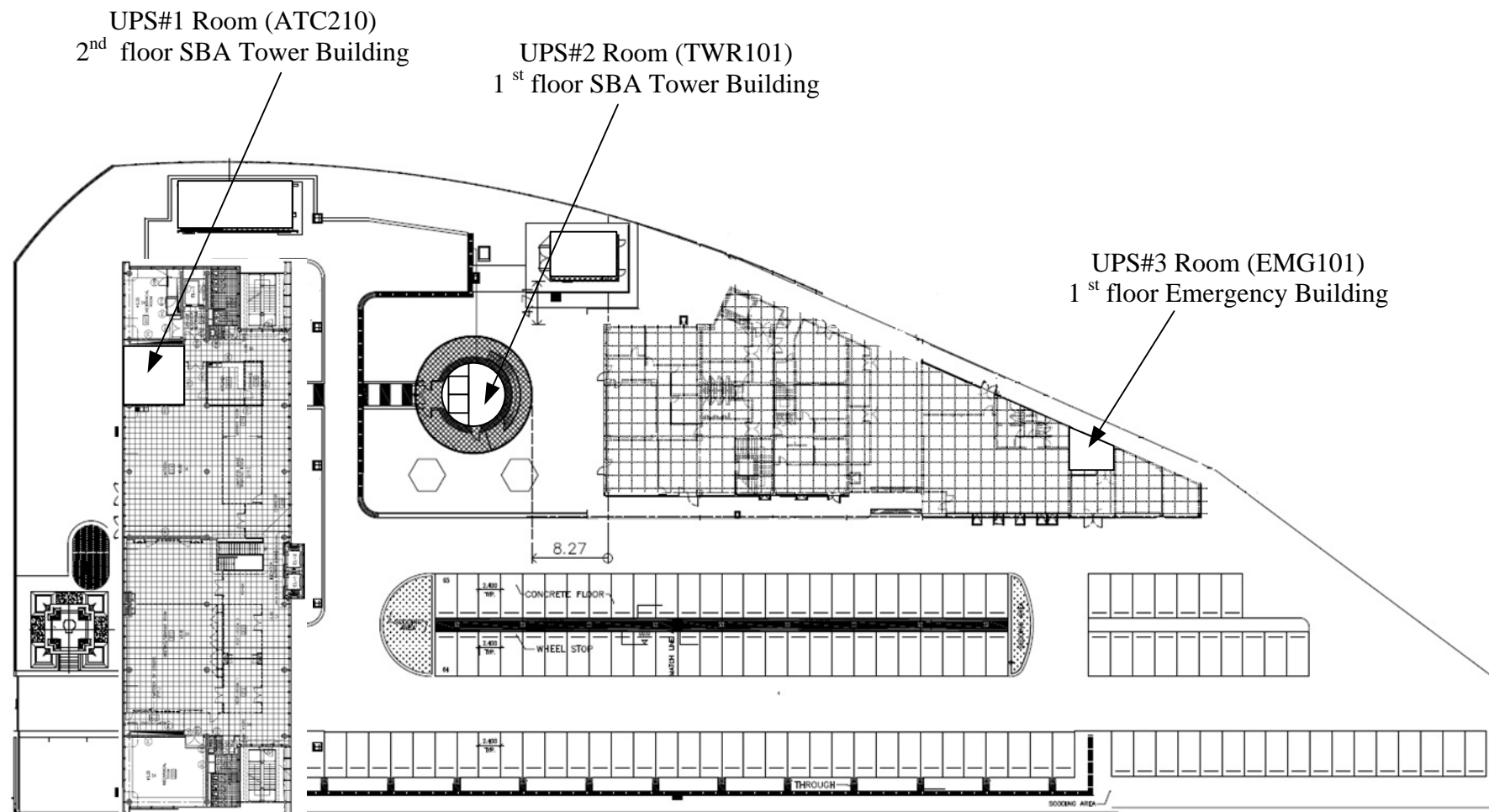


T7 floor SBA Tower Building Floor Plan



3rd floor Emergency Building Floor Plan

Attachment 6.1.3d The location of the CON/TRA Room, Pilot Room and Equipment Room of BAPP CON/TRA



Attachment 6.1.7e The location of the UPS#1 Room, UPS#2 Room and UPS#3 at Suvarnabhumi Airport Site

2 Dimension Layout of workstations and operator roles.

1. Figure 5.1 Conceptual Operator Role Layout of NAS MOPS at Tung Mahamek Site
2. Figure 5.2 Conceptual Operator Role Layout of NAS CON/TRA at Tung Mahamek Site
3. Figure 5.3 Conceptual Operator Role Layout of APP MOPS and APP CON/TRA at Provincial Site
4. Figure 5.4 Conceptual Operator Role Layout of BAPP MOPS and BAPP CON/TRA at Suvarnabhumi Airport Site
- Figure 5.5 Conceptual Operator Role Layout of SBA LTS at Suvarnabhumi Airport Site
5. Figure 5.5 Conceptual Operator Role Layout of SBA LTS at Suvarnabhumi Airport Site
6. Figure 5.6 Conceptual Operator Role Layout of LTS/RTS at Local Tower and Remote Tower

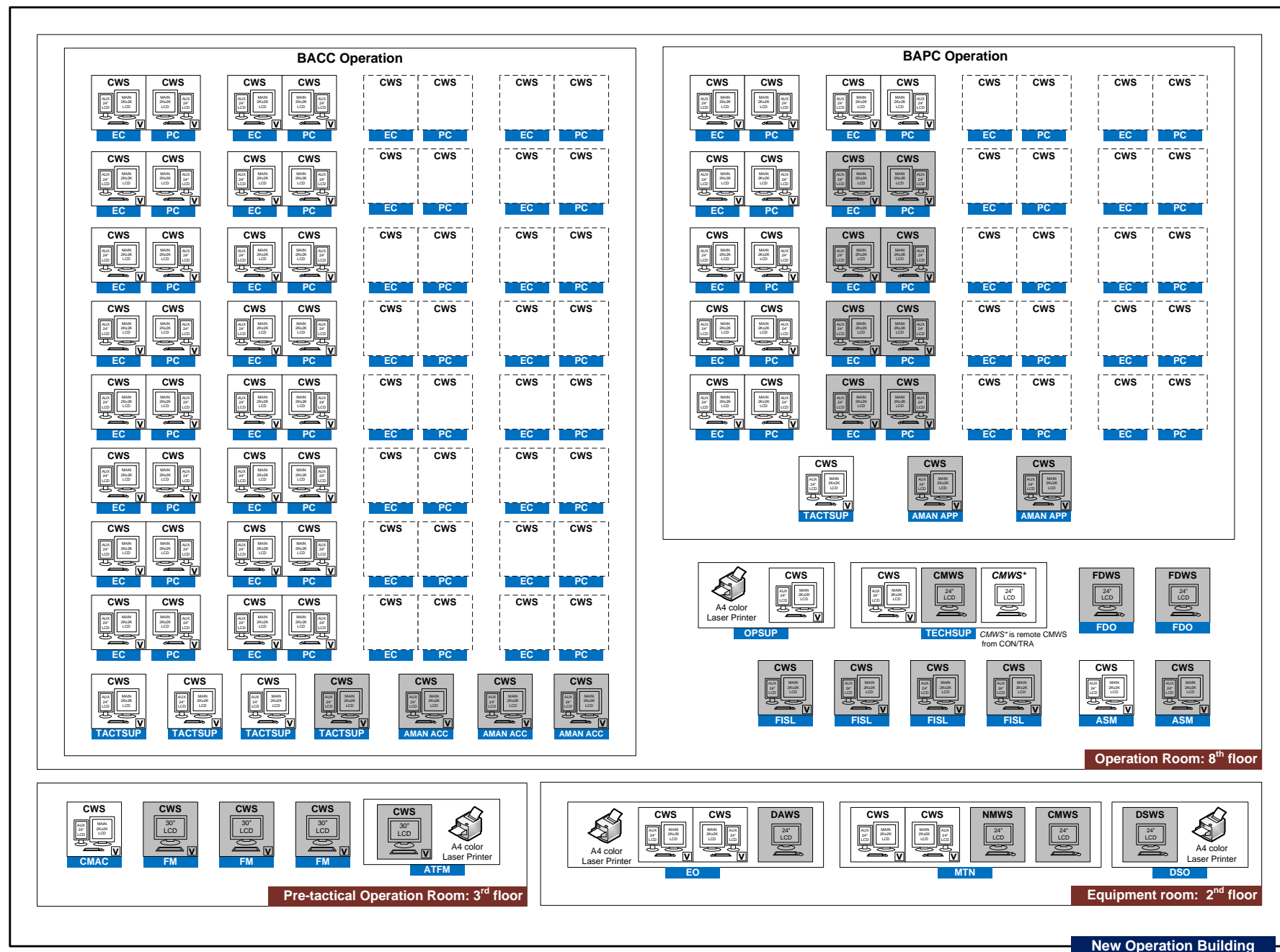


Figure 5.1 Conceptual Operator Role Layout of NAS MOPS at Tung Mahamek Site

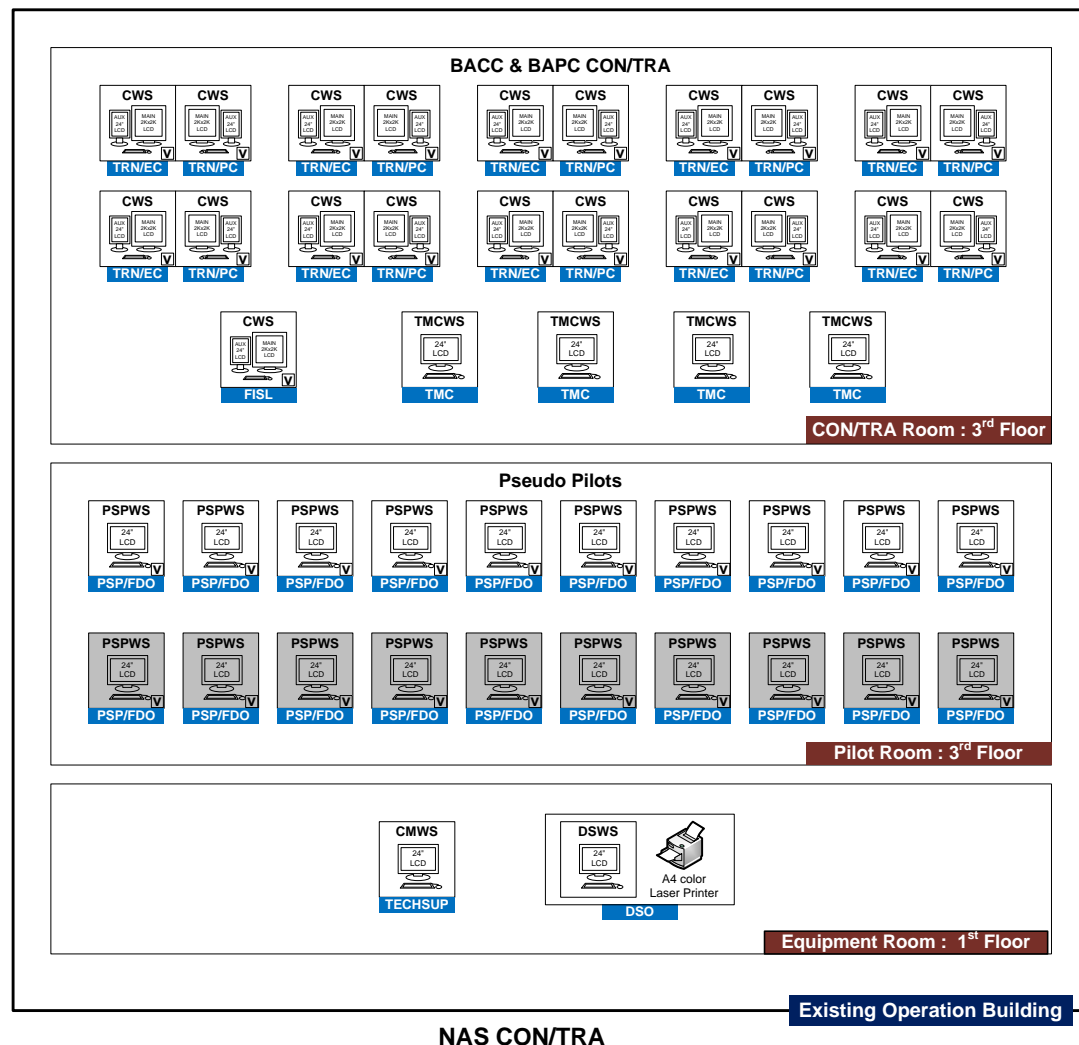
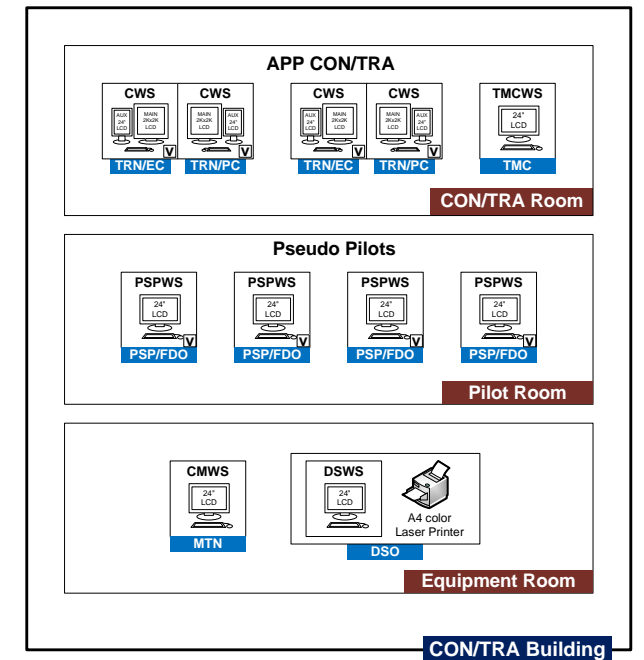
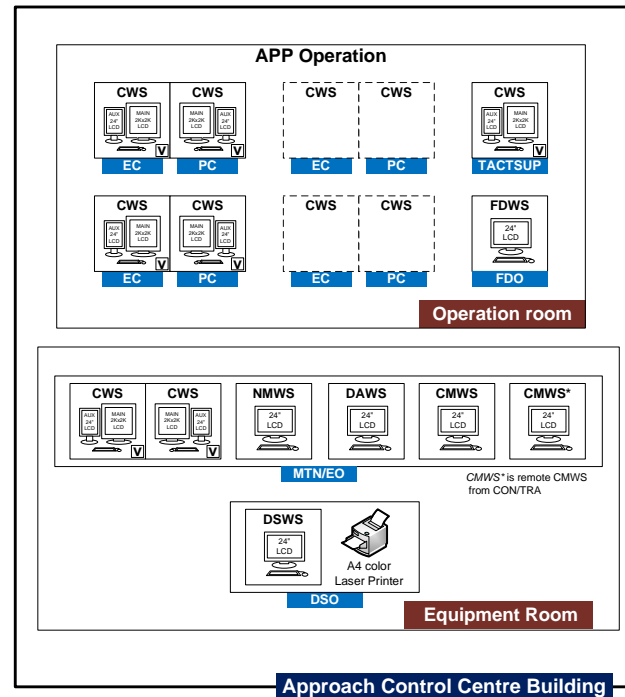
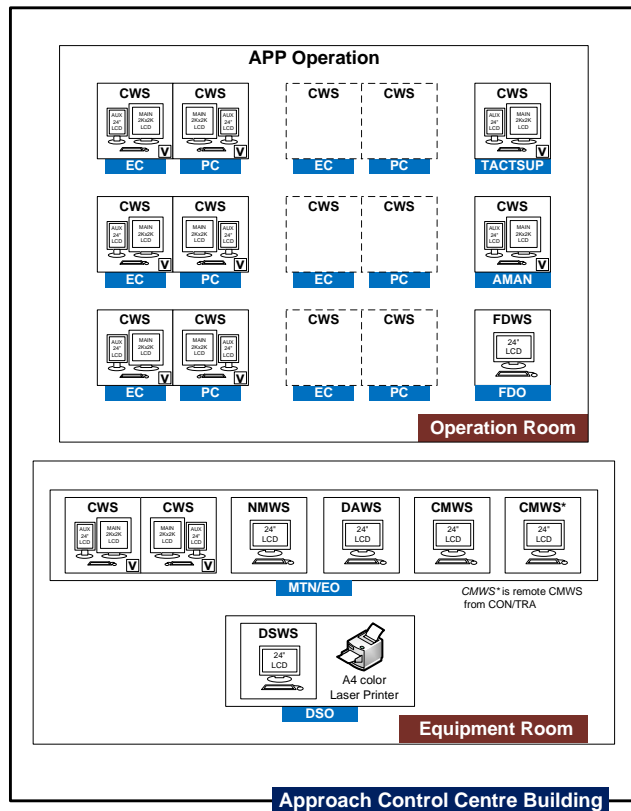


Figure 5.2 Conceptual Operator Role Layout of NAS CON/TRA at Tung Mahamek Site



Essential WS
 Optional WS
 Future Expansion
 V Voice Touch Entry Display

Figure 5.3 Conceptual Operator Role Layout of APP MOPS and APP CON/TRA at Provincial Site

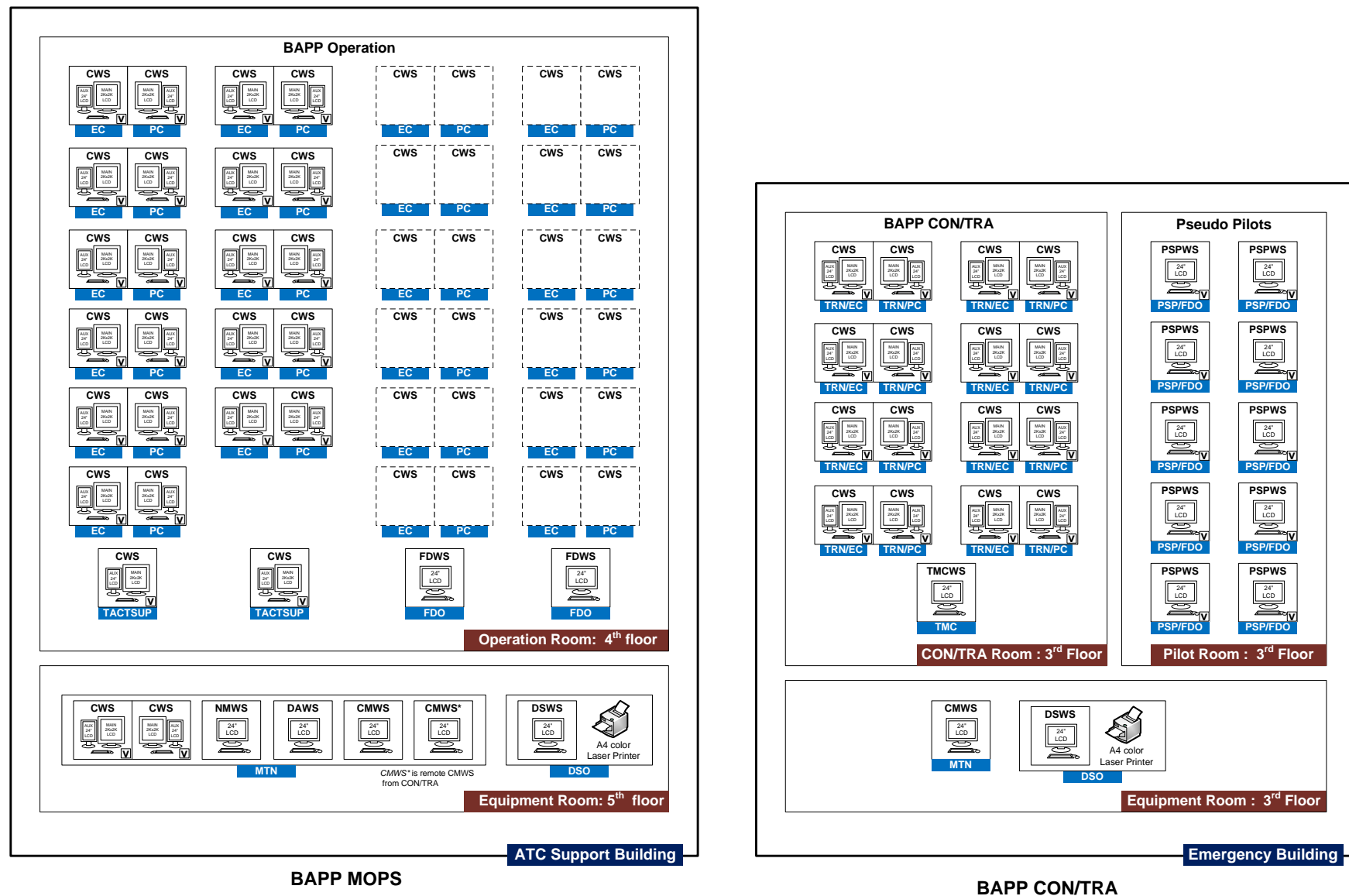
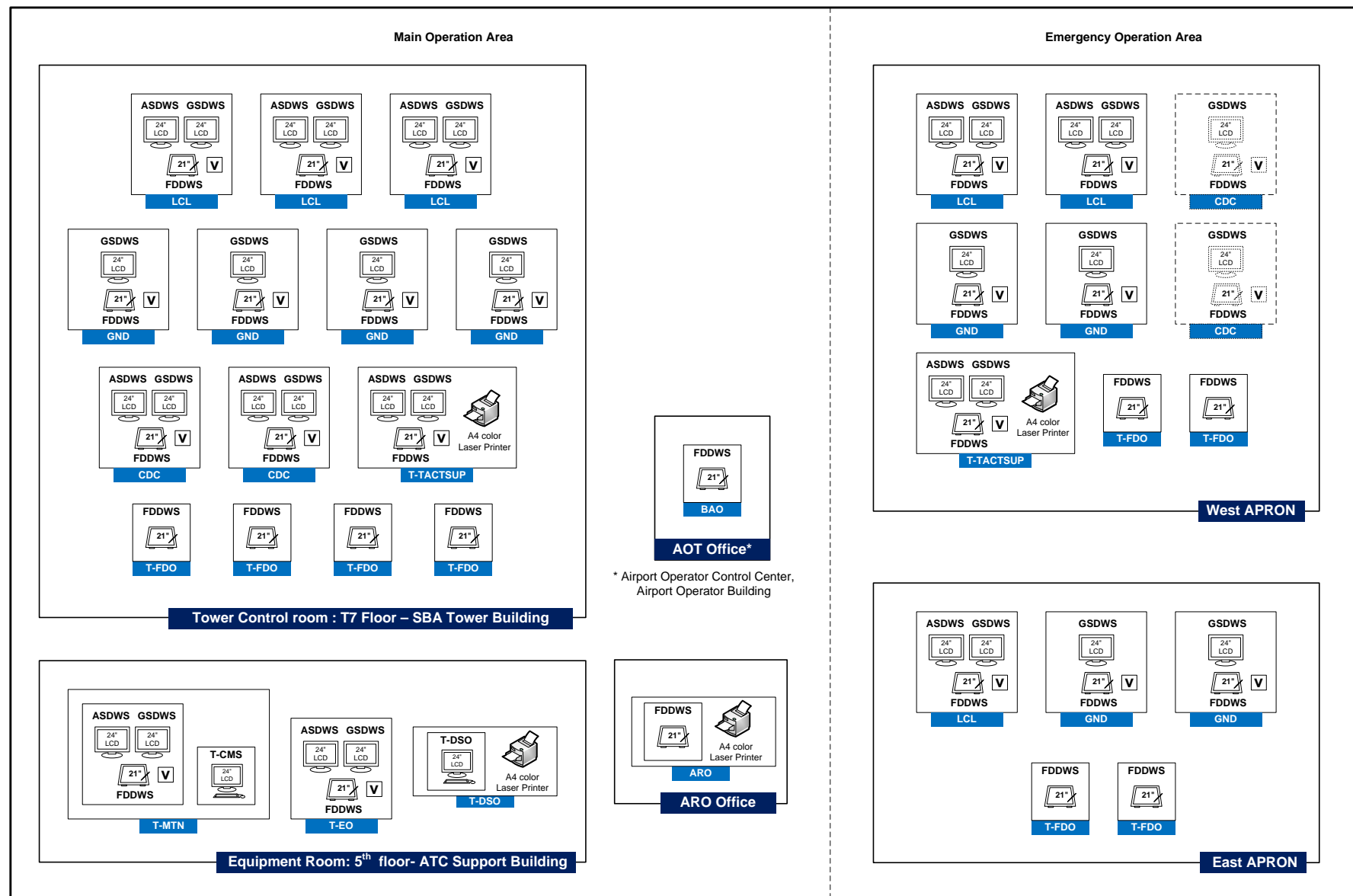


Figure 5.4 Conceptual Operator Role Layout of BAPP MOPS and BAPP CON/TRA at Suvarnabhumi Airport Site



SBA LTS – Level IV

Essential WS
 Optional WS
 Future Expansion

V
 Voice Touch Entry Display

Figure 5.5 Conceptual Operator Role Layout of SBA LTS at Suvarnabhumi Airport Site

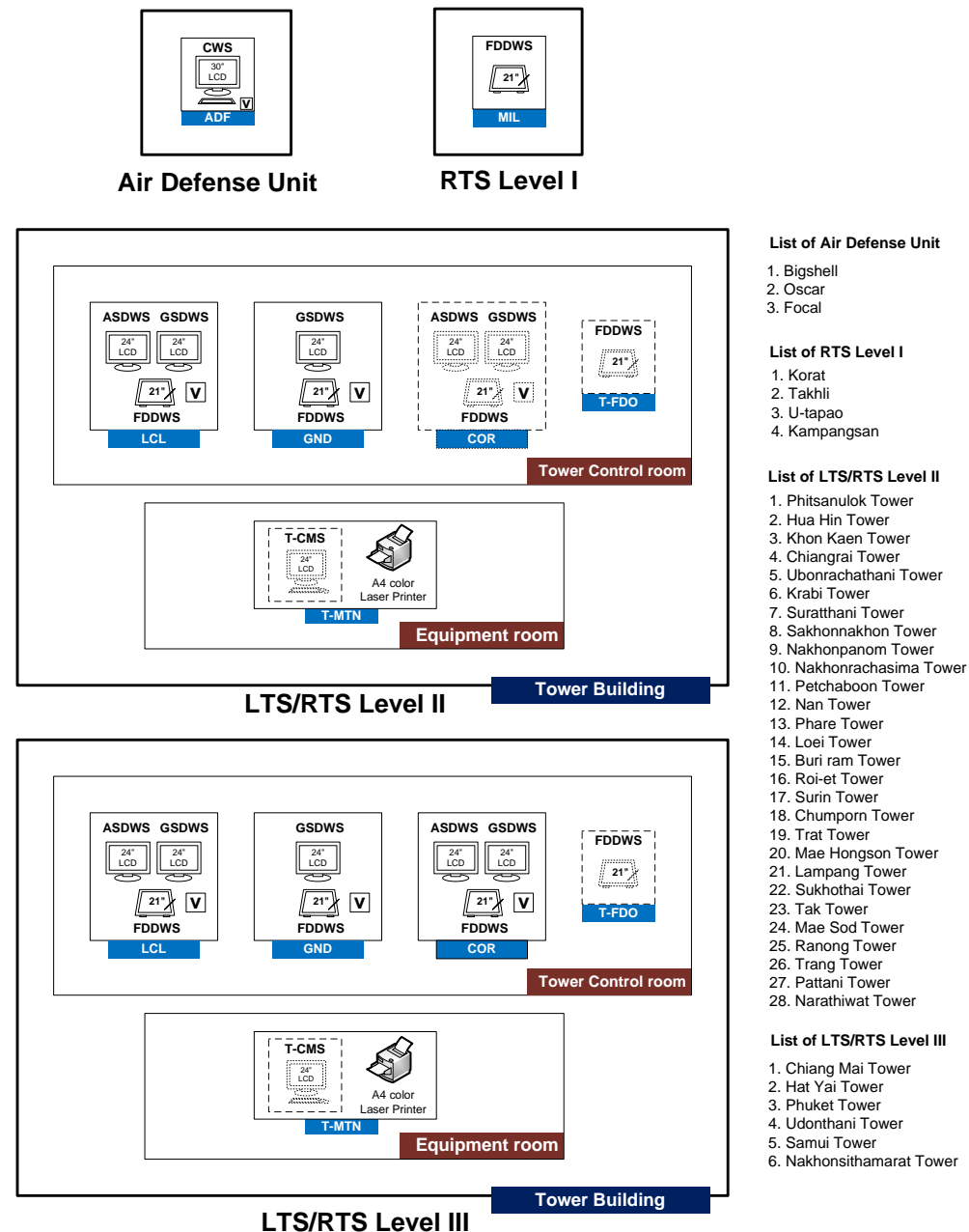
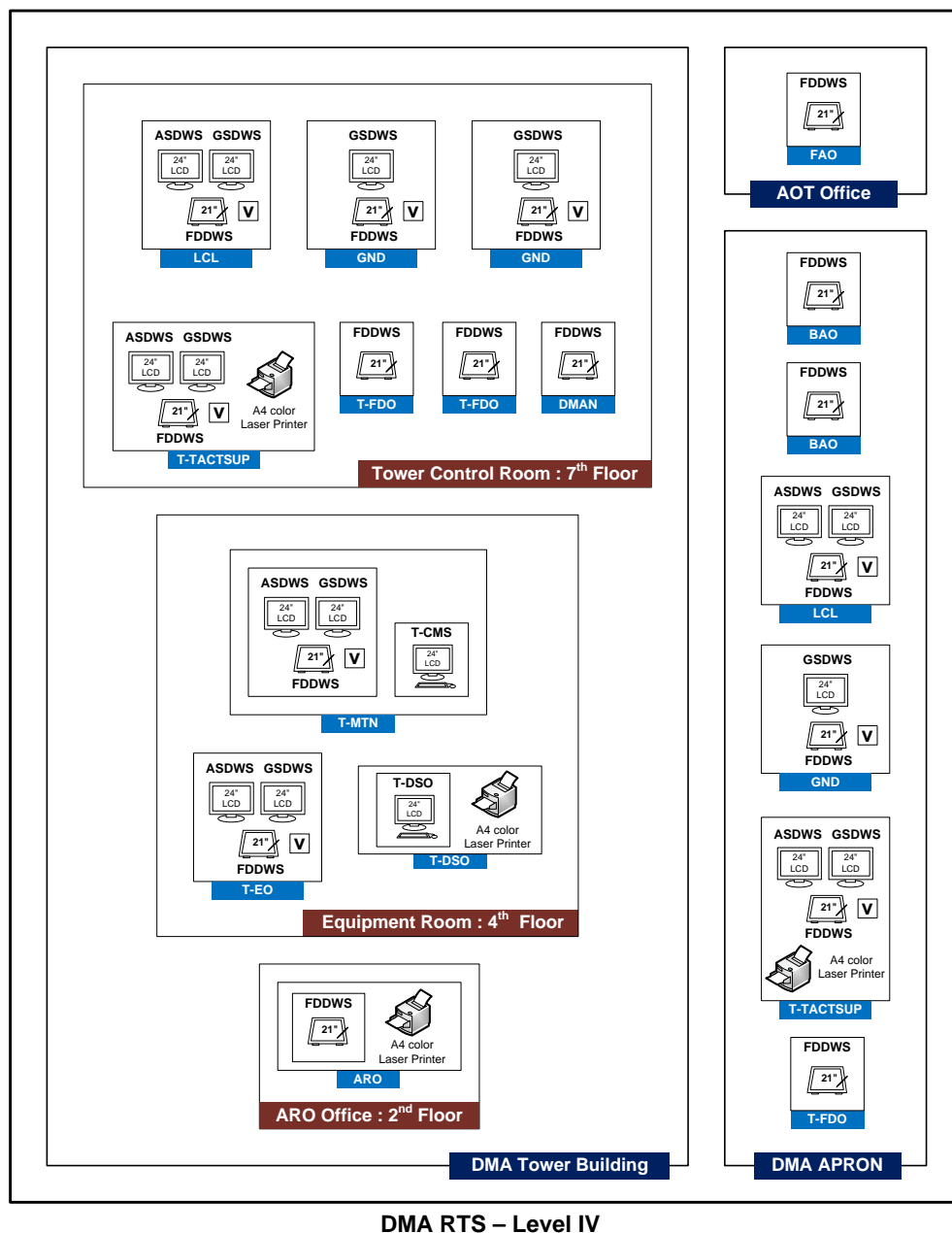


Figure 5.6 Conceptual Operator Role Layout of LTS/RTS at Local Tower and Remote Tower

3.1 Workstations capacity of each site.

APPENDIX 3.1.1 : Tungmahamek Main (Fallback) POSITION CAPACITY

POSITION	NAME	OPERATION
1	EC1	Area
2	PC1	Area
3	EC2	Area
4	PC2	Area
5	EC3	Area
6	PC3	Area
7	EC4	Area
8	PC4	Area
9	EC5	Area
10	PC5	Area
11	EC6	Area
12	PC6	Area
13	EC7	Area
14	PC7	Area
15	EC8	Area
16	PC8	Area
17	EC9	Area
18	PC9	Area
19	EC10	Area
20	PC10	Area
21	EC11	Area
22	PC11	Area
23	EC12	Area
24	PC12	Area
25	EC13	Area
26	PC13	Area
27	EC14	Area
28	PC14	Area
29	EC15	Area
30	PC15	Area
31	EC16	Area
32	PC16	Area
33	TACTSUP1	Area
34	TACTSUP2	Area
35	TACTSUP3	Area
36	EC1	Approach
37	PC1	Approach
38	EC2	Approach
39	PC2	Approach
40	EC3	Approach
41	PC3	Approach
42	EC4	Approach
43	PC4	Approach
44	EC5	Approach
45	PC5	Approach
46	EC6	Approach
47	PC6	Approach
48	TACTSUP	Approach

POSITION	NAME	OPERATION
49	OPSUP	Operation
50	TECHSUP	Operation
51	ASM	Operation
52	CMAC	Pre-tactical
53	EO1	Maint
54	EO2	Maint
55	MTN1	Maint
56	MTN2	Maint
57	TACTSUP*	Area (Option)
58	AMAN1*	Area (Option)
59	AMAN2*	Area (Option)
60	AMAN3*	Area (Option)
61	EC7*	Approach (Option)
62	PC7*	Approach (Option)
63	EC8*	Approach (Option)
64	PC8*	Approach (Option)
65	EC9*	Approach (Option)
66	PC9*	Approach (Option)
67	EC10*	Approach (Option)
68	PC10*	Approach (Option)
69	AMAN1*	Approach (Option)
70	AMAN2*	Approach (Option)
71	FISL1*	Operation (Option)
72	FISL2*	Operation (Option)
73	FISL3*	Operation (Option)
74	FISL4*	Operation (Option)
75	ASM*	Operation (Option)
76	FM1*	Pre-tactical (Option)
77	FM2*	Pre-tactical (Option)
78	FM3*	Pre-tactical (Option)
79	ATFM*	Pre-tactical (Option)

APPENDIX 3.1.2 : CMA HTY PUT PSL HHN Main (Fallback) POSITION CAPACITY

Location	Operation Role Position	CMA	HTY	PUT	PSL	HHN
Approach Control Room	EC + PC APP	6	6	6	4	4
	FDO	-	-	-	-	-
	AMAN	1	1	1	-	-
	TS APP	1	1	1	1	1
Tower Control Room	EC + PC TWR	4	4	4	4	4
	TS TWR	1	1	1	1	1
Technical Room	MTN / EO	2	2	2	2	2
	DSO	-	-	-	-	-
Total		15	15	15	12	12

Fallback System Require Only at Control Rooms

APPENDIX 3.1.3 : Tungmahamek CONTRA POSITION CAPACITY

POSITION	NAME	OPERATION
1	TRN/EC1	Area&Approach
2	TRN/PC1	Area&Approach
3	TRN/EC2	Area&Approach
4	TRN/PC2	Area&Approach
5	TRN/EC3	Area&Approach
6	TRN/PC3	Area&Approach
7	TRN/EC4	Area&Approach
8	TRN/PC4	Area&Approach
9	TRN/EC5	Area&Approach
10	TRN/PC5	Area&Approach
11	TRN/EC6	Area&Approach
12	TRN/PC6	Area&Approach
13	TRN/EC7	Area&Approach
14	TRN/PC7	Area&Approach
15	TRN/EC8	Area&Approach
16	TRN/PC8	Area&Approach
17	TRN/EC9	Area&Approach
18	TRN/PC9	Area&Approach
19	TRN/EC10	Area&Approach
20	TRN/PC10	Area&Approach
21	FISL	Area&Approach
22	PSP/FDO1	Area&Approach
23	PSP/FDO2	Area&Approach
24	PSP/FDO3	Area&Approach
25	PSP/FDO4	Area&Approach
26	PSP/FDO5	Area&Approach
27	PSP/FDO6	Area&Approach
28	PSP/FDO7	Area&Approach
29	PSP/FDO8	Area&Approach
30	PSP/FDO9	Area&Approach
31	PSP/FDO10	Area&Approach
32	PSP/FDO11*	Area&Approach (Option)
33	PSP/FDO12*	Area&Approach (Option)
34	PSP/FDO13*	Area&Approach (Option)
35	PSP/FDO14*	Area&Approach (Option)
36	PSP/FDO15*	Area&Approach (Option)
37	PSP/FDO16*	Area&Approach (Option)
38	PSP/FDO17*	Area&Approach (Option)
39	PSP/FDO18*	Area&Approach (Option)
40	PSP/FDO19*	Area&Approach (Option)
41	PSP/FDO20*	Area&Approach (Option)

APPENDIX 3.1.4 : CMA HTY PUT PSL HHN CONTRA POSITION CAPACITY

Location	Contingency	Training	CMA	HTY	PUT	PSL	HHN
CONTRA Room	EC + PC APP	TRN	4	4	4	4	4
	FDO	PSP	4	4	4	4	4
Total			8	8	8	8	8

3.2 Telephone lines capacity of each site.

APPENDIX 3.2.1 : Tungmahamek Main (Fallback) Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	SUP	WATCH CE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
2	SUP	WATCH SE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
3	ALL	ATFM	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
4	ALL	FD	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
5	ALL	FDO	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
6	Sector 1	APP_E1	2-Wire	Voice	Voice	Voice Call Interface
7	Sector 1	APP_E2	2-Wire	Voice	Voice	Voice Call Interface
8	Sector 1	APP_S	2-Wire	Voice	Voice	Voice Call Interface
9	Sector 1	APP_W	2-Wire	Voice	Voice	Voice Call Interface
10	Sector 2	APP_E1	2-Wire	Voice	Voice	Voice Call Interface
11	Sector 2	APP_E2	2-Wire	Voice	Voice	Voice Call Interface
12	Sector 3	APP_E1	2-Wire	Voice	Voice	Voice Call Interface
13	Sector 3	APP_E2	2-Wire	Voice	Voice	Voice Call Interface
14	Sector 3	APP_S	2-Wire	Voice	Voice	Voice Call Interface
15	Sector 4	APP_E1	2-Wire	Voice	Voice	Voice Call Interface
16	Sector 4	APP_E2	2-Wire	Voice	Voice	Voice Call Interface
17	Sector 4	APP_N	2-Wire	Voice	Voice	Voice Call Interface
18	Sector 4	APP_W	2-Wire	Voice	Voice	Voice Call Interface
19	Sector 4/1	APP_N	2-Wire	Voice	Voice	Voice Call Interface
20	Sector 4/1	APP_S	2-Wire	Voice	Voice	Voice Call Interface
21	Sector 4/1	APP_W	2-Wire	Voice	Voice	Voice Call Interface
22	TC1	TD	2-Wire	Voice	Voice	Voice Call Interface
23	TC2	TD	2-Wire	Voice	Voice	Voice Call Interface
24	TC1	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
25	TC1	BHM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
26	TC1	OSCAR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
27	TC2	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
28	TC2	BHM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
29	TC2	OSCAR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
30	Sector 1	DM1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
31	Sector 1	SVB_FDO1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
32	Sector 1	SVB_GND1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
33	Sector 1	BUT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
34	Sector 1	HHN_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
35	Sector 1	KPS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
36	Sector 1	OSCAR_S1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
37	Sector 1	Wing 5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
38	Sector 1	PHN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
39	Sector 1/1	YGN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
40	Sector 1/1	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
41	Sector 2	DM2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
42	Sector 2	SVB_FDO2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
43	Sector 2	SVB_GND2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
44	Sector 2	BGS_SRT1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
45	Sector 2	DSY	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
46	Sector 2	KRT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
47	Sector 2	OSCAR_S2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
48	Sector 2	PHN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
49	Sector 2	VTN_S	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
50	Sector 3	DM3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
51	Sector 3	HHN_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
52	Sector 3	SVB_FDO3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
53	Sector 3	SVB_GND3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
54	Sector 3	BUT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
55	Sector 3	OSCAR_S3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
56	Sector 3	HCM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
57	Sector 3	KUL3_SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
58	Sector 3	PHN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
59	Sector 4	(F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
60	Sector 4	(SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
61	Sector 4	DM4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
62	Sector 4	PSL_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
63	Sector 4	SVB_FDO4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
64	Sector 4	SVB_GND4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
65	Sector 4	BGS_SRT3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
66	Sector 4	BHM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
67	Sector 4	Focal	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
68	Sector 4	DSY	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
69	Sector 4	FAN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
70	Sector 4	KPS_Radar	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
71	Sector 4	KPS_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
72	Sector 4	OSCAR_S4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
73	Sector 4	TL	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
74	Sector 4	Wing 5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
75	Sector 4	VTN_N	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
76	Sector 4	YGN4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
77	Sector 4/1	APPW_ASS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
78	Sector 4/1	DM4/1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
79	Sector 4/1	SVB_FDO4/1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
80	Sector 4/1	SVB_GND4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
81	Sector 4/1	SVB_TD	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
82	Sector 4/1	DSY	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
83	Sector 4/1	KPS_Radar	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
84	Sector 4/1	KPS_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
85	Sector 4/1	OSCAR_FF	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
86	Sector 4/1	TL	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
87	Sector 4/1	YGN4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
88	Sector 5	(F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
89	Sector 5	(SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
90	Sector 5	KBI_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
91	Sector 5	(F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
92	Sector 5	(DDN)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
93	Sector 5	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
94	Sector 5	BGS_SRT2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
95	Sector 5	BUT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
96	Sector 5	KPS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
97	Sector 5	OSCAR_S5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
98	Sector 5	SWALLOW	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
99	Sector 5	1_DDN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
100	Sector 5	4_DDN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
101	Sector 5	KUL5_SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
102	Sector 5	PHN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
103	Sector 5	YGN5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
104	Sector 6	KBI_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
105	Sector 6	(F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
106	Sector 6	(SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
107	Sector 6	(F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
108	Sector 6	(DDN)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
109	Sector 6	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
110	Sector 6	SWALLOW	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
111	Sector 6	OSCAR_S6	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
112	Sector 6	HCM_S	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
113	Sector 6	1_DDND	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
114	Sector 6	5_DDND	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
115	Sector 6	KUL6_SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
116	Sector 6	PNH	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
117	Sector 6	YGN5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
118	Sector 7	(F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
119	Sector 7	(SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
120	Sector 7	PSL_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
121	Sector 7	BHM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
122	Sector 7	Focal	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
123	Sector 7	DSY	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
124	Sector 7	FAN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
125	Sector 7	OSCAR_S7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
126	Sector 7	VTN_N	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
127	Sector 7	YGN7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
128	Sector 8	BHM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
129	Sector 8	DSY	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
130	Sector 8	OSCAR_S8	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
131	Sector 8	PNH	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
132	Sector 8	VTN_S	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
133	KKN Sector	(F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
134	KKN Sector	(SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
135	KKN Sector	LOY_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
136	KKN Sector	NKP_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
137	KKN Sector	SKN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
138	KKN Sector	UDN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
139	KKN Sector	ASR_UDN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
140	KKN Sector	BHM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
141	KKN Sector	KRT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
142	KKN Sector	OSC_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
143	KKN Sector	VTN_UD APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
144	KKN Sector	Tel. 2005	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
145	KKN Sector	Tel. 8611	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
146	KKN Sector	Tel. 9611	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
147	KKN Sector	3181	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
148	UBL Sector	BRM_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
149	UBL Sector	NKR_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
150	UBL Sector	ROT_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
151	UBL Sector	UBL_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
152	UBL Sector	ASR_UBL	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
153	UBL Sector	KRT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
154	UBL Sector	LON	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
155	UBL Sector	OSC_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
156	UBL Sector	VTN_UB APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
157	UBL Sector	Tel. 2006	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
158	UBL Sector	Tel. 8612	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
159	UBL Sector	Tel. 9612	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
160	UBL Sector	0095	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
161	SMU Sector	CPN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
162	SMU Sector	HTY_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
163	SMU Sector	NKS_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
164	SMU Sector	PUT_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
165	SMU Sector	SMU_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
166	SMU Sector	STN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
167	SMU Sector	TRD_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
168	SMU Sector	ASR_STN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
169	SMU Sector	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
170	SMU Sector	BUT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
171	SMU Sector	SWL	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
172	SMU Sector	Tel. 2003	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
173	SMU Sector	Tel. 8613	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
174	SMU Sector	Tel. 9613	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
175	SMU Sector	0199	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
176	CTR Sector	CTR_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
177	CTR Sector	NAN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
178	CTR Sector	PAE_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
179	CTR Sector	PCB_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
180	CTR Sector	PSL_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
181	CTR Sector	Focal	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
182	CTR Sector	FAN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
183	CTR Sector	OSC_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
184	CTR Sector	Tel. 2008	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
185	CTR Sector	Tel. 8614	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
186	CTR Sector	Tel. 9614	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
187	CTR Sector	0224	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
188	ALL	SPARE 1	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
189	ALL	SPARE 2	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
190	ALL	SPARE 3	2-Wire	Voice	Voice	Voice Call Interface
191	ALL	SPARE 4	2-Wire	Voice	Voice	Voice Call Interface
192	ALL	SPARE 5	2-Wire	Voice	Voice	Voice Call Interface
193	ALL	SPARE 6	2-Wire	Voice	Voice	Voice Call Interface
194	ALL	SPARE 7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
195	ALL	SPARE 8	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
196	ALL	SPARE 9	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
197	ALL	SPARE 10	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
198	ALL	SPARE 11	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
199	ALL	SPARE 12	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
200	ALL	SPARE 13	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.2 : Chiangmai Main (Fallback) Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	WATCH CE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
2	ALL	WATCH SE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
3	ALL	BACC S4 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	BACC S4 (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	BACC S7 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	BACC S7 (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	PSL	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	TEL. 2603 ATS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	TEL. 2605 ATS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	TEL. 2611 ATS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	TEL. 6760 ATS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	TEL. 57507 RTAF	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	TEL. 57521 RTAF	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	TEL. 3034028	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	FAN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	TEL. 4812	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	TEL. 4813	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	TEL. 4817	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	TEL. 4818	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	TEL. 4199	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	TEL. 4822	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	TEL. 4835	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	2W-PABX	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	TEL. 277776	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
25	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
26	ALL	AOT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
27	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
28	ALL	Spare 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
29	ALL	Spare 2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
30	ALL	Spare 3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
31	ALL	Spare 4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
32	ALL	Spare 5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
33	ALL	Spare 6	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
34	ALL	Spare 7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
35	ALL	Spare 8	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.3 : Hatyai Main (Fallback) Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	WATCH CE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
2	ALL	WATCH SE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
3	ALL	BACC S5 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	BACC S5 (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	BACC S6 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	BACC S6 (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	SMU APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	PUT APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	KRABI APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	NTW TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	TRN TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	PT TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	SKL TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	BTW	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	RONDA1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	RONDA2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	SRT 63523	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	SRT 63525	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	AOT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	TEL. 6812	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	TEL. 6813	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	TEL. 6817	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	TEL. 6818	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
25	ALL	TEL. 6833	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
26	ALL	TEL. 251-073	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
27	ALL	TEL. 251-074	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
28	ALL	TEL. 474-570	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
29	ALL	TEL. 474-572	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
30	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
31	ALL	Emergency 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
32	ALL	Emergency 2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
33	ALL	Emergency 3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
34	ALL	Spare 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
35	ALL	Spare 2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.4 : Phuket Main (Fallback) Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	WATCH CE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
2	ALL	WATCH SE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
3	ALL	WATCH NE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
4	ALL	WATCH DE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
5	ALL	Briefing	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
6	ALL	BACC S5 (TOT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	BACC S5 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	BACC S6 (TOT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	BACC S6 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	BACC S5_KBI (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	BACC S5_KBI (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SMU APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	HTY APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	KBI TWR (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	KBI TWR (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	RAN TWR (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	RAN TWR (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	SWALLO	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	TEL. 5812	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	TEL. 5813	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	TEL.5814	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	TEL. 5818	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	TEL. 5819	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
25	ALL	TEL. 5820	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
26	ALL	TEL. 327-195	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
27	ALL	TEL. 327-269	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
28	ALL	Crash phone 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
29	ALL	Crash phone 2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
30	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
31	ALL	AOT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
32	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
33	ALL	Spare 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
34	ALL	Spare 2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
35	ALL	Spare 3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.5 : Phitsanulok Main (Fallback) Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	WATCH CE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
2	ALL	WATCH SE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
3	ALL	WATCH NE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
4	ALL	WATCH DE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
5	ALL	Briefing	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
6	ALL	BACC S4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	BACC S7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	TAK TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	SKT TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	CTR APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	ATS 6709	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	ATS 7709	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	ATS 7715	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	ATS 7010	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	ATS 7016	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	H/L Dora	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	ICS 55988	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	TEL. 7000	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	TEL. 7015	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	TEL. 7016	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	TEL. 266-381	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	TEL. 301-425	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
25	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
26	ALL	Spare 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
27	ALL	Spare 2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
28	ALL	Spare 3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
29	ALL	Spare 4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
30	ALL	Spare 5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.6 : Huahin Main (Fallback) Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	WATCH CE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
2	ALL	WATCH SE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
3	ALL	Briefing	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	BACC_S1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	SBA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	ATS 2412	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	TEL. 5200	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	TEL. 5201	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	TEL. 5291	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	TEL. 5292	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	TEL. 520-830	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	TEL. 522-097	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	Wing 53	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	KPS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	BUT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	B/O	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	Spare 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	Spare 2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	Spare 3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	Spare 4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	Spare 5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
25	ALL	Spare 6	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
26	ALL	Spare 7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
27	ALL	Spare 8	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
28	ALL	Spare 9	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
29	ALL	Spare 10	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
30	ALL	Spare 11	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.7 : Tungmahamek CONTRA Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	Sector 1	APP_E1	2-Wire	Voice	Voice	Voice Call Interface
2	Sector 1	APP_E2	2-Wire	Voice	Voice	Voice Call Interface
3	Sector 1	APP_S	2-Wire	Voice	Voice	Voice Call Interface
4	Sector 1	APP_W	2-Wire	Voice	Voice	Voice Call Interface
5	Sector 2	APP_E1	2-Wire	Voice	Voice	Voice Call Interface
6	Sector 2	APP_E2	2-Wire	Voice	Voice	Voice Call Interface
7	Sector 3	APP_E1	2-Wire	Voice	Voice	Voice Call Interface
8	Sector 3	APP_E2	2-Wire	Voice	Voice	Voice Call Interface
9	Sector 3	APP_S	2-Wire	Voice	Voice	Voice Call Interface
10	Sector 4	APP_E1	2-Wire	Voice	Voice	Voice Call Interface
11	Sector 4	APP_E2	2-Wire	Voice	Voice	Voice Call Interface
12	Sector 4	APP_N	2-Wire	Voice	Voice	Voice Call Interface
13	Sector 4	APP_W	2-Wire	Voice	Voice	Voice Call Interface
14	TC1	TD	2-Wire	Voice	Voice	Voice Call Interface
15	Sector 1	DM1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	Sector 1	SVB_FDO1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	Sector 1	SVB_GND1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	Sector 1	BUT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	Sector 1	HHN_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	Sector 1	KPS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	Sector 1	OSCAR_S1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	Sector 1	PHN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	Sector 2	DM2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	Sector 2	SVB_FDO2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
25	Sector 2	SVB_GND2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
26	Sector 2	DSY	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
27	Sector 2	KRT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
28	Sector 2	OSCAR_S2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
29	Sector 2	PHN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
30	Sector 2	VTN_S	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
31	Sector 3	DM3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
32	Sector 3	HHN_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
33	Sector 3	SVB_FDO3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
34	Sector 3	SVB_GND3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
35	Sector 3	BUT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
36	Sector 3	OSCAR_S3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
37	Sector 3	HCM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
38	Sector 3	PHN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
39	Sector 4	CMA_APP (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
40	Sector 4	DM4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
41	Sector 4	PSL_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
42	Sector 4	SVB_FDO4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
43	Sector 4	SVB_GND4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
44	Sector 4	FAN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
45	Sector 4	KPS_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
46	Sector 4	OSCAR_S4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
47	Sector 4	TL	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
48	Sector 4	YGN4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
49	Sector 5	HTY_APP (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
50	Sector 5	KBI_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
51	Sector 5	PUT_APP (DDN)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
52	Sector 5	BGS_SRT2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
53	Sector 5	OSCAR_S5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
54	Sector 5	KUL_5-1_DDN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
55	Sector 5	KUL_5-4_DDN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
56	Sector 5	PHN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
57	Sector 5	YGN5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
58	Sector 6	KBI_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
59	Sector 6	HTY_APP (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
60	Sector 6	PUT_APP (DDN)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
61	Sector 6	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
62	Sector 6	HCM_S	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
63	Sector 6	KUL_6-1_DDN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
64	Sector 6	KUL_6-5_DDN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
65	Sector 6	PNH	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
66	Sector 7	CMA_APP (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
67	Sector 7	PSL_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
68	Sector 7	FOCAL	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
69	Sector 7	VTN_N	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
70	Sector 7	YGN7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
71	Sector 8	PNH	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
72	Sector 8	VTN_S	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
73	KKN Sector	(SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
74	KKN Sector	LOY_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
75	KKN Sector	NKP_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
76	KKN Sector	SKN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
77	KKN Sector	UDN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
78	KKN Sector	ASR_UDN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
79	KKN Sector	BHM	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
80	KKN Sector	KRT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
81	KKN Sector	OSC_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
82	KKN Sector	VTN_UD APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
83	KKN Sector	Tel. 2005	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
84	KKN Sector	Tel. 9611	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
85	KKN Sector	Tel. 02-287-3181	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
86	UBL Sector	BRM_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
87	UBL Sector	NKR_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
88	UBL Sector	ROT_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
89	UBL Sector	UBL_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
90	UBL Sector	ASR_UBL	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
91	UBL Sector	KRT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
92	UBL Sector	LON	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
93	UBL Sector	OSC_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
94	UBL Sector	VTN_UB APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
95	UBL Sector	Tel. 2006	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
96	UBL Sector	Tel. 9612	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
97	UBL Sector	Tel. 02-286-0095	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
98	SMU Sector	CPN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
99	SMU Sector	HTY_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
100	SMU Sector	NKS_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
101	SMU Sector	PUT_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
102	SMU Sector	SMU_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
103	SMU Sector	STN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
104	SMU Sector	TRD_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
105	SMU Sector	ASR_STN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
106	SMU Sector	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
107	SMU Sector	BUT_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
108	SMU Sector	Tel. 2003	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
109	SMU Sector	Tel. 9613	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
110	SMU Sector	Tel. 02-286-0199	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
111	CTR Sector	CTR_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
112	CTR Sector	NAN_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
113	CTR Sector	PAE_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
114	CTR Sector	PCB_TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
115	CTR Sector	FAN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
116	CTR Sector	OSC_APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
117	CTR Sector	Tel. 2008	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
118	CTR Sector	Tel. 9614	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
119	CTR Sector	Tel. 02-286-0224	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
120	Spare1	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
121	Spare2	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
122	Spare3	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
123	Spare4	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
124	Spare5	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
125	Spare6	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
126	Spare7	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
127	Spare8	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
128	Spare9	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
129	Spare10	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
130	Spare11	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
131	Spare12	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
132	Spare13	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
133	Spare14	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
134	Spare15	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
135	Spare16	Spare	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.8 : Chiangmai CONTRA Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	BACC S4 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	BACC S4 (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	BACC S7 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	BACC S7 (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	TEL. 2603 ATS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	TEL. 2605 ATS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	TEL. 2611 ATS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	TEL. 6760 ATS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	TEL. 57507 RTAF	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	TEL. 57521 RTAF	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	TEL. 3034028	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	FAN	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	TEL. 4812	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	TEL. 4813	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	TEL. 4817	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	TEL. 4818	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	TEL. 277776	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	AOT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	Spare1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	Spare2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	Spare3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	Spare4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.9 : Hatyai CONTRA Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	BACC S5 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	BACC S6 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	SMU APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	PUT APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	KRABI APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	NTW TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	TRN TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	PT TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	SKL TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	BTW	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	RONDA1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	RONDA2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	SRT 63523	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	AOT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	TEL. 6812	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	TEL. 6817	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	TEL. 251-073	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	TEL. 474-570	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	Spare1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	Spare2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	Spare3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	Spare4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.10 : Phuket CONTRA Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	Briefing	2-Wire	Loop-	Ring-Out	Telephone Set Interface
2	ALL	BACC S5 (TOT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	BACC S5 (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	BACC S6 (TOT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	BACC S5_KBI (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	BACC S5_KBI (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	SMU APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	HTY APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	KBI TWR (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	KBI TWR (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	RAN TWR (F/R)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	RAN TWR (SAT)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	BGS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	SWALLO	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	TEL. 5812	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	TEL. 5813	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	TEL. 5818	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	TEL. 5819	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	TEL. 327-195	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	Spare1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	Spare2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	Spare3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	Spare4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.11 : Phitsanulok CONTRA Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	Briefing	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
2	ALL	BACC S4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	BACC S7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	TAK TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	SKT TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	CTR APP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	ATS 6709	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	ATS 7709	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	ATS 7715	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	ATS 7010	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	ATS 7016	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	H//L Dora	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	ICS 55988	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	TEL. 7000	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	TEL. 7015	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	TEL. 7016	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	TEL. 266-381	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	TEL. 301-425	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	Spare1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	Spare2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	Spare3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	Spare4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 3.2.12 : Huahin CONTRA Telephone Channels Capacity

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	WATCH CE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
2	ALL	WATCH SE	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
3	ALL	Briefing	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	BACC_S1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	SBA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	ATS 2412	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	TEL. 5200	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	TEL. 5201	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	TEL. 5291	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	TEL. 5292	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	TEL. 520-830	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	TEL. 522-097	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	Wing 53	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	KPS	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	BUT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	B/O	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	Spare 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	Spare 2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	Spare 3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	Spare 4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	Spare 5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

3.3 Radio lines capacity of each site.

APPENDIX 3.3.1 : Tungmahamek Main (Fallback) Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	SECTOR 1	120.5	Local Main	FIBER
2	SECTOR 1	120.5	Local Stby	FIBER
3	SECTOR 1	120.5	KMN RCAG	DDN
4	SECTOR 1	120.5	KMN RCAG	SAT
5	SECTOR 1	120.5	HHN RCAG	F/R
6	SECTOR 1	256.6	Local Main	FIBER
7	SECTOR 1	256.6	Local Stby	FIBER
8	SECTOR 1	256.6	KMN RCAG	DDN
9	SECTOR 1	256.6	KMN RCAG	SAT
10	SECTOR 1 Upper	VHF	HHN RCAG	DDN
11	SECTOR 1 Upper	VHF	HHN RCAG	SAT
12	SECTOR 1 Upper	UHF	HHN RCAG	DDN
13	SECTOR 1 Upper	UHF	HHN RCAG	SAT
14	SECTOR 1/1	133.3	CPN RCAG	DDN
15	SECTOR 1/1	133.3	CPN RCAG	SAT
16	SECTOR 1/1	133.3	SMU RCAG	F/R
17	SECTOR 2	133.1	Local Main	FIBER
18	SECTOR 2	133.1	Local Stby	FIBER
19	SECTOR 2	133.1	KKN RCAG	DDN
20	SECTOR 2	133.1	KKN RCAG	F/R
21	SECTOR 2	133.1	UBL RCAG	DDN
22	SECTOR 2	133.1	UBL RCAG	SAT
23	SECTOR 2	133.1	KRT RCAG	DDN
24	SECTOR 2	133.1	KRT RCAG	SAT
25	SECTOR 2	133.1	BRM RCAG	F/R
26	SECTOR 2	285.3	Local Main	FIBER
27	SECTOR 2	285.3	Local Stby	FIBER
28	SECTOR 2	285.3	KKN RCAG	DDN
29	SECTOR 2	285.3	KKN RCAG	F/R
30	SECTOR 2	285.3	UBL RCAG	DDN
31	SECTOR 2	285.3	UBL RCAG	SAT
32	SECTOR 2	285.3	KRT RCAG	DDN
33	SECTOR 2	285.3	KRT RCAG	SAT
34	SECTOR 3	135.5	Local Main	FIBER
35	SECTOR 3	135.5	Local Stby	FIBER
36	SECTOR 3	135.5	KMN RCAG	DDN
37	SECTOR 3	135.5	KMN RCAG	SAT
38	SECTOR 3	135.5	TRAT RCAG	F/R
39	SECTOR 3	285.5	Local Main	FIBER
40	SECTOR 3	285.5	Local Stby	FIBER
41	SECTOR 3	285.5	KMN RCAG	DDN
42	SECTOR 3	285.5	KMN RCAG	SAT
43	SECTOR 4	128.1	Local Main	FIBER
44	SECTOR 4	128.1	Local Stby	FIBER
45	SECTOR 4	128.1	NSW RCAG	DDN
46	SECTOR 4	128.1	NSW RCAG	F/R
47	SECTOR 4	128.1	PSL RCAG	F/R
48	SECTOR 4	128.1	KKN RCAG	DDN

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
49	SECTOR 4	128.1	KKN RCAG	F/R
50	SECTOR 4	263.8	Local Main	FIBER
51	SECTOR 4	263.8	Local Stby	FIBER
52	SECTOR 4	263.8	NSW RCAG	DDN
53	SECTOR 4	263.8	NSW RCAG	F/R
54	SECTOR 4	263.8	KKN RCAG	DDN
55	SECTOR 4	263.8	KKN RCAG	F/R
56	SECTOR 4/1	122.05	Local Main	FIBER
57	SECTOR 4/1	122.05	Local Stby	FIBER
58	SECTOR 4/1	122.05	KAN (RTAF) RCAG	DDN
59	SECTOR 4/1	122.05	KAN (RTAF) RCAG	SAT
60	SECTOR 4/1	122.05	KAN (TOT) RCAG	DDN
61	SECTOR 4/1	UHF	Local Main	FIBER
62	SECTOR 4/1	UHF	Local Stby	FIBER
63	SECTOR 4/1	UHF	KAN (RTAF) RCAG	DDN
64	SECTOR 4/1	UHF	KAN (RTAF) RCAG	SAT
65	SECTOR 5	125.7	SMU RCAG	DDN
66	SECTOR 5	125.7	SMU RCAG	SAT
67	SECTOR 5	125.7	CPN RCAG	F/R
68	SECTOR 5	125.7	PUT RCAG	DDN
69	SECTOR 5	125.7	PUT RCAG	SAT
70	SECTOR 5	268.5	SMU RCAG	DDN
71	SECTOR 5	268.5	SMU RCAG	SAT
72	SECTOR 5	268.5	PUT RCAG	DDN
73	SECTOR 5	268.5	PUT RCAG	SAT
74	SECTOR 5	121.5	Emergency SMU RCAG	F/R
75	SECTOR 5 Upper	VHF	SRT RCAG	DDN
76	SECTOR 5 Upper	VHF	SRT RCAG	SAT
77	SECTOR 5 Upper	UHF	SRT RCAG	DDN
78	SECTOR 5 Upper	UHF	SRT RCAG	SAT
79	SECTOR 6	123.95	SMU RCAG	DDN
80	SECTOR 6	123.95	SMU RCAG	SAT
81	SECTOR 6	123.95	NKS RCAG	F/R
82	SECTOR 6	123.95	HTY RCAG	DDN
83	SECTOR 6	123.95	HTY RCAG	SAT
84	SECTOR 6	265.9	SMU RCAG	DDN
85	SECTOR 6	265.9	SMU RCAG	SAT
86	SECTOR 6	265.9	HTY RCAG	DDN
87	SECTOR 6	265.9	HTY RCAG	SAT
88	SECTOR 6	121.5	Emergency SMU RCAG	F/R
89	SECTOR 7	132.1	DOI RCAG	DDN
90	SECTOR 7	132.1	DOI RCAG	SAT
91	SECTOR 7	132.1	LPN RCAG	F/R
92	SECTOR 7	132.1	UDN RCAG	DDN
93	SECTOR 7	132.1	UDN RCAG	SAT
94	SECTOR 7	132.1	LOI RCAG	F/R
95	SECTOR 7	246.5	DOI RCAG	DDN
96	SECTOR 7	246.5	DOI RCAG	SAT
97	SECTOR 7	246.5	UDN RCAG	DDN
98	SECTOR 7	246.5	UDN RCAG	SAT
99	SECTOR 7	121.5	Emergency INT RCAG	F/R

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
100	SECTOR 7	121.5	Emergency UDN RCAG	F/R
101	SECTOR 7/1	VHF	UDN RCAG	DDN
102	SECTOR 7/1	VHF	UDN RCAG	SAT
103	SECTOR 7/1	VHF	LOY RCAG	DDN
104	SECTOR 7/1	VHF	LOY RCAG	SAT
105	SECTOR 7/1	UHF	UDN RCAG	DDN
106	SECTOR 7/1	UHF	UDN RCAG	SAT
107	SECTOR 7/1	UHF	LOY RCAG	DDN
108	SECTOR 7/1	UHF	LOY RCAG	SAT
109	SECTOR 8	133.9	KKN RCAG	DDN
110	SECTOR 8	133.9	KKN RCAG	SAT
111	SECTOR 8	133.9	UBL RCAG	DDN
112	SECTOR 8	133.9	UBL RCAG	SAT
113	SECTOR 8	133.9	ROI RCAG	F/R
114	SECTOR 8	268.5	KKN RCAG	DDN
115	SECTOR 8	268.5	KKN RCAG	SAT
116	SECTOR 8	268.5	UBL RCAG	DDN
117	SECTOR 8	268.5	UBL RCAG	SAT
118	SECTOR 8	121.5	Emergency UBL RCAG	F/R
119	Sector 1-4	121.5	Emergency Local Main	FIBER
120	Sector 1-4	121.5	Emergency Local Stby	FIBER
121	Sector 1-4	243.0	Emergency Local Main	FIBER
122	Sector 1-4	243.0	Emergency Local Stby	FIBER
123	ALL	132.05	F/C Main1	FIBER
124	ALL	132.05	F/C Stby1	FIBER
125	ALL	124.1	F/C Main2	FIBER
126	ALL	124.1	F/C Stby2	FIBER
127	Sector 1-4	122.75	Backup 1 Main	FIBER
128	Sector 1-4	122.75	Backup 1 Stby	FIBER
129	Sector 1-4	120.5,133.1,135.5,128.1	DM Backup 1	F/R,SAT
130	Sector 1-4	120.5,133.1,135.5,128.1	DM Backup 2	F/R,SAT
131	Sector 1-4	120.5,133.1,135.5,128.1	DM Backup 3	F/R,SAT
132	Sector 1-4	120.5,133.1,135.5,128.1	DM Backup 4	F/R,SAT
133	Sector 1-4	120.5,133.1,135.5,128.1	SB Backup 1	F/R
134	Sector 1-4	120.5,133.1,135.5,128.1	SB Backup 2	F/R
135	Sector 1-4	120.5,133.1,135.5,128.1	SB Backup 3	F/R
136	Sector 1-4	120.5,133.1,135.5,128.1	SB Backup 4	F/R
137	Sector 1-4	120.5,133.1,135.5,128.1	SB Backup 5	F/R
138	Sector 1-4	120.5,133.1,135.5,128.1	SB Backup 6	F/R
139	Sector 5,6	125.7,123.95	SMU Backup 1	F/R
140	Sector 5,6	125.7,123.95	SMU Backup 2	F/R
141	Sector 1,3	120.5,135.5	KMN Backup	F/R
142	Sector 2,8	133.1,133.9	UBL Backup	F/R
143	SB CDC S1	120.8	CDC SB Main	DDN,F/R
144	SB CDC S1	120.8	CDC SB Stby	DDN,F/R
145	SB CDC S2	133.8	CDC SB Main	DDN,F/R
146	SB CDC S2	133.8	CDC SB Stby	DDN,F/R
147	SB CDC S3	135.8	CDC SB Main	DDN,F/R
148	SB CDC S3	135.8	CDC SB Stby	DDN,F/R
149	SB CDC S4	128.7	CDC SB Main	DDN,F/R
150	SB CDC S4	128.7	CDC SB Stby	DDN,F/R

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
151	KKN APP	123.4	KKN APP RCAG	SAT
152	KKN APP	123.4	KKN APP RCAG	F/R
153	KKN APP	240.0	KKN APP RCAG	SAT
154	KKN APP	240.0	KKN APP RCAG	F/R
155	KKN APP	123.35	SKN APP RCAG	SAT
156	KKN APP	123.35	SKN APP RCAG	F/R
157	KKN APP	284.0	SKN APP RCAG	SAT
158	KKN APP	284.0	SKN APP RCAG	F/R
159	KKN APP	126.2	UDN APP RCAG	SAT
160	KKN APP	126.2	UDN APP RCAG	F/R
161	KKN APP	268.5	UDN APP RCAG	SAT
162	KKN APP	268.5	UDN APP RCAG	F/R
163	KKN APP	122.55	LOY APP RCAG	SAT
164	KKN APP	122.55	LOY APP RCAG	F/R
165	KKN APP	240.0	LOY APP RCAG	SAT
166	KKN APP	240.0	LOY APP RCAG	F/R
167	UBL APP	123.5	UBL APP RCAG	SAT
168	UBL APP	123.5	UBL APP RCAG	F/R
169	UBL APP	257.8	UBL APP RCAG	SAT
170	UBL APP	257.8	UBL APP RCAG	F/R
171	UBL APP	125.4	ROT APP RCAG	SAT
172	UBL APP	125.4	ROT APP RCAG	F/R
173	UBL APP	UHF	ROT APP RCAG	SAT
174	UBL APP	UHF	ROT APP RCAG	F/R
175	UBL APP	123.6	KRT APP RCAG	SAT
176	UBL APP	123.6	KRT APP RCAG	F/R
177	UBL APP	UHF	KRT APP RCAG	SAT
178	UBL APP	UHF	KRT APP RCAG	F/R
179	UBL APP	119.45	BRM APP RCAG	F/R
180	UBL APP	119.45	BRM APP RCAG	F/R
181	UBL APP	UHF	BRM APP RCAG	F/R
182	UBL APP	UHF	BRM APP RCAG	F/R
183	SMU APP	129.6	SMU APP RCAG (Airport)	SAT
184	SMU APP	305.4	SMU APP RCAG (Airport)	SAT
185	SMU APP	129.6	SMU APP RCAG (Khaophom)	SAT
186	SMU APP	129.6	SMU APP RCAG (Khaophom)	F/R
187	SMU APP	305.4	SMU APP RCAG (Khaophom)	SAT
188	SMU APP	305.4	SMU APP RCAG (Khaophom)	F/R
189	SMU APP	119.75	NKS APP RCAG	SAT
190	SMU APP	119.75	NKS APP RCAG	F/R
191	SMU APP	UHF	NKS APP RCAG	SAT
192	SMU APP	UHF	NKS APP RCAG	F/R
193	SMU APP	123.35	STN APP RCAG	SAT
194	SMU APP	123.35	STN APP RCAG	F/R

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
195	SMU APP	240.0	STN APP RCAG	SAT
196	SMU APP	240.0	STN APP RCAG	F/R
197	SMU APP	118.6	TRAT APP RCAG	SAT
198	SMU APP	118.6	TRAT APP RCAG	F/R
199	SMU APP	UHF	TRAT APP RCAG	SAT
200	SMU APP	UHF	TRAT APP RCAG	F/R
201	CTR APP	120.05	CTR APP RCAG	SAT
202	CTR APP	120.05	CTR APP RCAG	F/R
203	CTR APP	257.8	CTR APP RCAG	SAT
204	CTR APP	257.8	CTR APP RCAG	F/R
205	CTR APP	120.25	NAN APP RCAG	SAT
206	CTR APP	120.25	NAN APP RCAG	F/R
207	CTR APP	UHF	NAN APP RCAG	SAT
208	CTR APP	UHF	NAN APP RCAG	F/R
209	CTR APP	120.1	PAE APP RCAG	SAT
210	CTR APP	120.1	PAE APP RCAG	F/R
211	CTR APP	UHF	PAE APP RCAG	SAT
212	CTR APP	UHF	PAE APP RCAG	F/R
213	CTR APP	126.7	PCB APP RCAG	SAT
214	CTR APP	126.7	PCB APP RCAG	F/R
215	CTR APP	UHF	PCB APP RCAG	SAT
216	CTR APP	UHF	PCB APP RCAG	F/R
217	FIAS Site1	VHF	RCAG	DDN
218	FIAS Site1	VHF	RCAG	F/R
219	FIAS Site2	VHF	RCAG	DDN
220	FIAS Site2	VHF	RCAG	F/R
221	FIAS Site3	VHF	RCAG	DDN
222	FIAS Site3	VHF	RCAG	F/R
223	FIAS Site4	VHF	RCAG	DDN
224	FIAS Site4	VHF	RCAG	F/R
225	FIAS Site5	VHF	RCAG	DDN
226	FIAS Site5	VHF	RCAG	F/R
227	FIAS Site6	VHF	RCAG	DDN
228	FIAS Site6	VHF	RCAG	F/R
229	FIAS Site7	VHF	RCAG	DDN
230	FIAS Site7	VHF	RCAG	F/R
231	FIAS Site8	VHF	RCAG	DDN
232	FIAS Site8	VHF	RCAG	F/R
233	FIAS Site9	VHF	RCAG	DDN
234	FIAS Site9	VHF	RCAG	F/R
235	FIAS Site10	VHF	RCAG	DDN
236	FIAS Site10	VHF	RCAG	F/R
237	FIAS Site11	VHF	RCAG	DDN
238	FIAS Site11	VHF	RCAG	F/R
239	FIAS Site12	VHF	RCAG	DDN
240	FIAS Site12	VHF	RCAG	F/R
241	ALL	VHF	Spare F1 Main	
242	ALL	VHF	Spare F1 Stby	
243	ALL	VHF	Spare F2 Main	
244	ALL	VHF	Spare F2 Stby	
245	ALL	VHF	Spare F3 Main	

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
246	ALL	VHF	Spare F3 Stby	
247	ALL	VHF	Spare F4 Main	
248	ALL	VHF	Spare F4 Stby	
249	ALL	VHF	Spare F5 Main	
250	ALL	VHF	Spare F5 Stby	
251	ALL	VHF	Spare F6 Main	
252	ALL	VHF	Spare F6 Stby	
253	ALL	VHF	Spare F7 Main	
254	ALL	VHF	Spare F7 Stby	
255	ALL	VHF	Spare F8 Main	
256	ALL	VHF	Spare F8 Stby	
257	ALL	VHF	Spare F9 Main	
258	ALL	VHF	Spare F9 Stby	
259	ALL	VHF	Spare F10 Main	
260	ALL	VHF	Spare F10 Stby	
261	ALL	VHF	Spare F11 Main	
262	ALL	VHF	Spare F11 Stby	
263	ALL	VHF	Spare F12 Main	
264	ALL	VHF	Spare F12 Stby	

APPENDIX 3.3.2 : Chiangmai Main (Fallback) Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Ground	121.900	Local Main	FIBER
2	Ground	121.900	Local Stby	FIBER
3	Ground	275.800	Local Main	FIBER
4	Ground	275.800	Local Stby	FIBER
5	Local	118.100	Local Main	FIBER
6	Local	118.100	Local Stby	FIBER
7	Local	236.600	Local Main	FIBER
8	Local	236.600	Local Stby	FIBER
9	Approach	129.600	Local Main	FIBER
10	Approach	129.600	Local Stby	FIBER
11	Approach	305.400	Local Main	FIBER
12	Approach	305.400	Local Stby	FIBER
13	Approach	129.600	RCAG INT	SAT
14	Approach	129.600	RCAG INT	DDN
15	Approach	305.400	RCAG INT	SAT
16	Approach	305.400	RCAG INT	DDN
17	LPN Approach	119.300	RCAG LPN	SAT
18	LPN Approach	119.300	RCAG LPN	DDN
19	MST Approach	120.650	RCAG MST	SAT
20	MST Approach	120.650	RCAG MST	DDN
21	MHS Approach	126.200	RCAG MHS	SAT
22	MHS Approach	126.200	RCAG MHS	DDN
23	All	127.200	CATIS	Copper
24	All	301.500	CATIS	Copper
25	All	121.500	Emergency	FIBER
26	All	121.500	Emergency	FIBER
27	All	243.000	Emergency	FIBER
28	All	243.000	Emergency	FIBER
29	Approach	132.050	Flight Check	FIBER
30	Area	INT-S7	Emergency	Copper
31	Area	UDN-S7	Emergency	Copper
32	Area	UBL-S8	Emergency	Copper
33	Area	KKN-S8	Emergency	Copper
34	Approach Sector	CTR-APP	Emergency	Copper
35	All	Spare 1	Main	FIBER
36	All	Spare 1	Stby	FIBER
37	All	Spare 2	Main	FIBER
38	All	Spare 2	Stby	FIBER
39	All	Spare 3	Main	FIBER
40	All	Spare 3	Stby	FIBER

APPENDIX 3.3.3 : Hatyai Main (Fallback) Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Ground	121.900	Local Main	FIBER
2	Ground	121.900	Local Stby	FIBER
3	Ground	257.800	Local Main	FIBER
4	Ground	257.800	Local Stby	FIBER
5	Local	118.100	Local Main	FIBER
6	Local	118.100	Local Stby	FIBER
7	Local	275.800	Local Main	FIBER
8	Local	275.800	Local Stby	FIBER
9	Approach	126.700	Local Main	FIBER
10	Approach	126.700	Local Stby	FIBER
11	Approach	301.500	Local Main	FIBER
12	Approach	301.500	Local Stby	FIBER
13	NTW Approach	125.550	Local Main	FIBER
14	NTW Approach	125.550	RCAG NTW	SAT
15	NTW Approach	125.550	RCAG NTW	DDN,F/R
16	NTW Approach	284.000	RCAG NTW	SAT
17	NTW Approach	284.000	RCAG NTW	DDN,F/R
18	TRN Approach	125.300	Local Main	FIBER
19	TRN Approach	125.300	RCAG TRN	SAT
20	TRN Approach	125.300	RCAG TRN	DDN,F/R
21	PT Approach	126.000	Local Main	FIBER
22	PT Approach	126.000	RCAG PT	SAT
23	PT Approach	126.000	RCAG PT	DDN,F/R
24	All	128.800	CATIS	Copper
25	All	121.450	BACKUP	FIBER
26	All	121.500	Emergency	FIBER
27	All	121.500	Emergency	FIBER
28	All	243.000	Emergency	FIBER
29	All	243.000	Emergency	FIBER
30	Approach	132.050	Flight Check	FIBER
31	Area	HTY-S6	Emergency	Copper
32	Approach Sector	SMU-APP	Emergency	Copper
33	All	Spare 1	Main	FIBER
34	All	Spare 1	Stby	FIBER
35	All	Spare 2	Main	FIBER
36	All	Spare 2	Stby	FIBER
37	All	Spare 3	Main	FIBER
38	All	Spare 3	Stby	FIBER
39	All	Spare 4	Main	FIBER
40	All	Spare 4	Stby	FIBER

APPENDIX 3.3.4 : Phuket Main (Fallback) Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Ground	121.900	Local Main	FIBER
2	Ground	121.900	Local Stby	FIBER
3	Ground	UHF	Local Main	FIBER
4	Ground	UHF	Local Stby	FIBER
5	Local	118.100	Local Main	FIBER
6	Local	118.100	Local Stby	FIBER
7	Local	236.600	Local Main	FIBER
8	Local	236.600	Local Stby	FIBER
9	Approach	124.700	Local Main	FIBER
10	Approach	124.700	Local Stby	FIBER
11	Approach	284.000	Local Main	FIBER
12	Approach	284.000	Local Stby	FIBER
13	Approach	120.700	Local Main	FIBER
14	Approach	120.700	Local Stby	FIBER
15	KBI Approach	120.050	Local Main	DDN
16	KBI Approach	120.050	RCAG KBI	F/R
17	KBI Approach	120.050	RCAG KBI	SAT
18	RAN Approach	125.100	RCAG RAN	F/R
19	RAN Approach	125.100	RCAG RAN	SAT
20	All	128.000	CATIS	Copper
21	All	122.450	BACKUP	FIBER
22	All	121.500	Emergency	FIBER
23	All	121.500	Emergency	FIBER
24	All	243.000	Emergency	FIBER
25	All	243.000	Emergency	FIBER
26	Approach	132.050	Flight Check	FIBER
27	Area	PUT-S5	Emergency	FIBER
28	Approach Sector	SMU-APP	Emergency	FIBER
29	Approach	APP PUT SUB1	Local Main	FIBER
30	Approach	APP PUT SUB1	Local Stby	FIBER
31	Approach	APP PUT SUB2	Local Main	FIBER
32	Approach	APP PUT SUB2	Local Stby	FIBER
33	Approach	CDC	Local Main	FIBER
34	Approach	CDC	Local Stby	FIBER
35	All	Spare 1	Main	FIBER
36	All	Spare 1	Stby	FIBER
37	All	Spare 2	Main	FIBER
38	All	Spare 2	Stby	FIBER
39	All	Spare 3	Main	FIBER
40	All	Spare 3	Stby	FIBER

APPENDIX 3.3.5 : Phitsanulok Main (Fallback) Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Ground	121.900	Local Main	Copper
2	Ground	121.900	Local Stby	Copper
3	Local	118.900	Local Main	Copper
4	Local	118.900	Local Stby	Copper
5	Local	236.600	Local Main	Copper
6	Local	236.600	Local Stby	Copper
7	Approach	120.700	Local Main	Copper
8	Approach	120.700	Local Stby	Copper
9	Approach	284.000	Local Main	Copper
10	Approach	284.000	Local Stby	Copper
11	TAK Approach	126.000	RCAG TAK	SAT
12	TAK Approach	126.000	RCAG TAK	F/R
13	All	119.450	BACKUP Main	Copper
14	All	119.450	BACKUP Stby	Copper
15	All	121.500	Emergency	Copper
16	All	121.500	Emergency	Copper
17	All	243.000	Emergency	Copper
18	All	243.000	Emergency	Copper
19	Approach	132.050	Flight Check Main	Copper
20	Approach	132.050	Flight Check Main	Copper
21	All	Spare 1	Main	Copper
22	All	Spare 1	Stby	Copper
23	All	Spare 2	Main	Copper
24	All	Spare 2	Stby	Copper
25	All	Spare 3	Main	Copper
26	All	Spare 3	Stby	Copper
27	All	Spare 4	Main	Copper
28	All	Spare 4	Stby	Copper
29	All	Spare 5	Main	Copper
30	All	Spare 5	Stby	Copper

APPENDIX 3.3.6 : Huahin Main (Fallback) Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Ground	121.900	Local Main	Copper
2	Ground	121.900	Local Stby	Copper
3	Local	122.700	Local Main	Copper
4	Local	122.700	Local Stby	Copper
5	Local	UHF	Local Main	Copper
6	Local	UHF	Local Stby	Copper
7	Approach	126.200	Local Main	Copper
8	Approach	126.200	Local Stby	Copper
9	Approach	236.600	Local Main	Copper
10	Approach	236.600	Local Stby	Copper
11	Area	120.500	Offsite	Copper
12	Area	VHF	S1_Upper	Copper
13	All	133.000	BACKUP Main	Copper
14	All	133.000	BACKUP Stby	Copper
15	All	121.500	Emergency	Copper
16	All	121.500	Emergency	Copper
17	All	243.000	Emergency	Copper
18	All	243.000	Emergency	Copper
19	Approach	132.050	Flight Check Main	Copper
20	Approach	132.050	Flight Check Main	Copper
21	All	Spare 1	Main	Copper
22	All	Spare 1	Stby	Copper
23	All	Spare 2	Main	Copper
24	All	Spare 2	Stby	Copper
25	All	Spare 3	Main	Copper
26	All	Spare 3	Stby	Copper
27	All	Spare 4	Main	Copper
28	All	Spare 4	Stby	Copper
29	All	Spare 5	Main	Copper
30	All	Spare 5	Stby	Copper

APPENDIX 3.3.7 : Tungmahamek CONTRA Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	SECTOR 1	120.5	Local Main	FIBER
2	SECTOR 1	120.5	Local Stby	FIBER
3	SECTOR 1	120.5	KMN RCAG	DDN
4	SECTOR 1	120.5	KMN RCAG	SAT
5	SECTOR 1	120.5	HHN RCAG	F/R
6	SECTOR 1	256.6	Local Main	FIBER
7	SECTOR 1	256.6	KMN RCAG	DDN
8	SECTOR 2	133.1	Local Main	FIBER
9	SECTOR 2	133.1	Local Stby	FIBER
10	SECTOR 2	133.1	KKN RCAG	DDN
11	SECTOR 2	133.1	KKN RCAG	F/R
12	SECTOR 2	133.1	UBL RCAG	DDN
13	SECTOR 2	133.1	UBL RCAG	SAT
14	SECTOR 2	133.1	KRT RCAG	DDN
15	SECTOR 2	133.1	KRT RCAG	SAT
16	SECTOR 2	133.1	BRM RCAG	F/R
17	SECTOR 2	285.3	Local Main	FIBER
18	SECTOR 2	285.3	KKN RCAG	DDN
19	SECTOR 2	285.3	UBL RCAG	DDN
20	SECTOR 2	285.3	KRT RCAG	DDN
21	SECTOR 3	135.5	Local Main	FIBER
22	SECTOR 3	135.5	Local Stby	FIBER
23	SECTOR 3	135.5	KMN RCAG	DDN
24	SECTOR 3	135.5	KMN RCAG	SAT
25	SECTOR 3	135.5	TRAT RCAG	F/R
26	SECTOR 3	285.5	Local Main	FIBER
27	SECTOR 3	285.5	KMN RCAG	DDN
28	SECTOR 4	128.1	Local Main	FIBER
29	SECTOR 4	128.1	Local Stby	FIBER
30	SECTOR 4	128.1	NSW RCAG	DDN
31	SECTOR 4	128.1	NSW RCAG	F/R
32	SECTOR 4	128.1	PSL RCAG	F/R
33	SECTOR 4	128.1	KKN RCAG	DDN
34	SECTOR 4	128.1	KKN RCAG	F/R
35	SECTOR 4	263.8	Local Main	FIBER
36	SECTOR 4	263.8	NSW RCAG	DDN
37	SECTOR 4	263.8	KKN RCAG	DDN
38	SECTOR 5	125.7	SMU RCAG	DDN
39	SECTOR 5	125.7	SMU RCAG	SAT
40	SECTOR 5	125.7	CPN RCAG	F/R
41	SECTOR 5	125.7	PUT RCAG	DDN
42	SECTOR 5	125.7	PUT RCAG	SAT
43	SECTOR 5	268.5	SMU RCAG	DDN
44	SECTOR 5	268.5	PUT RCAG	DDN
45	SECTOR 5	121.5	Emergency SMU RCAG	F/R
46	SECTOR 6	123.95	SMU RCAG	DDN
47	SECTOR 6	123.95	SMU RCAG	SAT
48	SECTOR 6	123.95	NKS RCAG	F/R

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
49	SECTOR 6	123.95	HTY RCAG	DDN
50	SECTOR 6	123.95	HTY RCAG	SAT
51	SECTOR 6	265.9	SMU RCAG	DDN
52	SECTOR 6	265.9	HTY RCAG	DDN
53	SECTOR 7	132.1	DOI RCAG	DDN
54	SECTOR 7	132.1	DOI RCAG	SAT
55	SECTOR 7	132.1	LPN RCAG	F/R
56	SECTOR 7	132.1	UDN RCAG	DDN
57	SECTOR 7	132.1	UDN RCAG	SAT
58	SECTOR 7	132.1	LOI RCAG	F/R
59	SECTOR 7	246.5	DOI RCAG	DDN
60	SECTOR 7	246.5	UDN RCAG	DDN
61	SECTOR 7	121.5	Emergency INT RCAG	F/R
62	SECTOR 7	121.5	Emergency UDN RCAG	F/R
63	SECTOR 8	133.9	KKN RCAG	DDN
64	SECTOR 8	133.9	KKN RCAG	SAT
65	SECTOR 8	133.9	UBL RCAG	DDN
66	SECTOR 8	133.9	UBL RCAG	SAT
67	SECTOR 8	133.9	ROI RCAG	F/R
68	SECTOR 8	268.5	KKN RCAG	DDN
69	SECTOR 8	268.5	UBL RCAG	DDN
70	SECTOR 8	121.5	Emergency UBL RCAG	F/R
71	Sector 1-4	121.5	Emergency Local Main	FIBER
72	Sector 1-4	121.5	Emergency Local Stby	FIBER
73	Sector 1-4	243.0	Emergency Local Main	FIBER
74	Sector 1,3	120.5,135.5	KMN Backup	F/R
75	Sector 2,8	133.1,133.9	UBL Backup	F/R
76	SB CDC_S1	120.8	CDC SB Main	DDN,F/R
77	SB CDC_S1	120.8	CDC SB Stby	DDN,F/R
78	SB CDC_S2	133.8	CDC SB Main	DDN,F/R
79	SB CDC_S2	133.8	CDC SB Stby	DDN,F/R
80	SB CDC_S3	135.8	CDC SB Main	DDN,F/R
81	SB CDC_S3	135.8	CDC SB Stby	DDN,F/R
82	SB CDC_S4	128.7	CDC SB Main	DDN,F/R
83	SB CDC_S4	128.7	CDC SB Stby	DDN,F/R
84	KKN APP	123.4	KKN APP RCAG	SAT
85	KKN APP	123.4	KKN APP RCAG	F/R
86	KKN APP	240.0	KKN APP RCAG	SAT
87	KKN APP	123.35	SKN APP RCAG	SAT
88	KKN APP	123.35	SKN APP RCAG	F/R
89	KKN APP	284.0	SKN APP RCAG	SAT
90	KKN APP	126.2	UDN APP RCAG	SAT
91	KKN APP	126.2	UDN APP RCAG	F/R
92	KKN APP	268.5	UDN APP RCAG	SAT
93	KKN APP	122.55	LOY APP RCAG	SAT
94	KKN APP	122.55	LOY APP RCAG	F/R
95	KKN APP	240.0	LOY APP RCAG	SAT
96	UBL APP	123.5	UBL APP RCAG	SAT
97	UBL APP	123.5	UBL APP RCAG	F/R
98	UBL APP	257.8	UBL APP RCAG	SAT
99	UBL APP	125.4	ROT APP RCAG	SAT

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
100	UBL APP	125.4	ROT APP RCAG	F/R
101	UBL APP	123.6	KRT APP RCAG	SAT
102	UBL APP	123.6	KRT APP RCAG	F/R
103	UBL APP	119.45	BRM APP RCAG	F/R
104	UBL APP	119.45	BRM APP RCAG	F/R
105	SMU APP	129.6	SMU APP RCAG (Khaophom)	SAT
106	SMU APP	129.6	SMU APP RCAG (Khaophom)	F/R
107	SMU APP	305.4	SMU APP RCAG (Khaophom)	SAT
108	SMU APP	119.75	NKS APP RCAG	SAT
109	SMU APP	119.75	NKS APP RCAG	F/R
110	SMU APP	123.35	STN APP RCAG	SAT
111	SMU APP	123.35	STN APP RCAG	F/R
112	SMU APP	240.0	STN APP RCAG	SAT
113	SMU APP	118.6	TRAT APP RCAG	SAT
114	SMU APP	118.6	TRAT APP RCAG	F/R
115	CTR APP	120.05	CTR APP RCAG	SAT
116	CTR APP	120.05	CTR APP RCAG	F/R
117	CTR APP	257.8	CTR APP RCAG	SAT
118	CTR APP	120.25	NAN APP RCAG	SAT
119	CTR APP	120.25	NAN APP RCAG	F/R
120	CTR APP	120.1	PAE APP RCAG	SAT
121	CTR APP	120.1	PAE APP RCAG	F/R
122	CTR APP	126.7	PCB APP RCAG	SAT
123	CTR APP	126.7	PCB APP RCAG	F/R
124	FIAS Site1	VHF	RCAG	DDN
125	FIAS Site2	VHF	RCAG	DDN
126	FIAS Site3	VHF	RCAG	DDN
127	FIAS Site4	VHF	RCAG	DDN
128	FIAS Site5	VHF	RCAG	DDN
129	FIAS Site6	VHF	RCAG	DDN
130	FIAS Site7	VHF	RCAG	DDN
131	FIAS Site8	VHF	RCAG	DDN
132	FIAS Site9	VHF	RCAG	DDN
133	FIAS Site10	VHF	RCAG	DDN
134	FIAS Site11	VHF	RCAG	DDN
135	FIAS Site12	VHF	RCAG	DDN
136	Spare 1	Spare 1	Spare 1	x
137	Spare 2	Spare 2	Spare 2	x
138	Spare 3	Spare 3	Spare 3	x
139	Spare 4	Spare 4	Spare 4	x
140	Spare 5	Spare 5	Spare 5	x
141	Spare 6	Spare 6	Spare 6	x
142	Spare 7	Spare 7	Spare 7	x
143	Spare 8	Spare 8	Spare 8	x
144	Spare 9	Spare 9	Spare 9	x
145	Spare 10	Spare 10	Spare 10	x
146	Spare 11	Spare 11	Spare 11	x
147	Spare 12	Spare 12	Spare 12	x
148	Spare 13	Spare 13	Spare 13	x
149	Spare 14	Spare 14	Spare 14	x
150	Spare 15	Spare 14	Spare 14	x

APPENDIX 3.3.8 : Chiangmai CONTRA Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Approach	129.600	Local Main	FIBER
2	Approach	129.600	Local Stby	FIBER
3	Approach	305.400	Local Main	FIBER
4	Approach	129.600	RCAG INT	SAT
5	Approach	129.600	RCAG INT	DDN
6	Approach	305.400	RCAG INT	SAT
7	LPN Approach	119.300	RCAG LPN	SAT
8	LPN Approach	119.300	RCAG LPN	DDN
9	MST Approach	120.650	RCAG MST	SAT
10	MST Approach	120.650	RCAG MST	DDN
11	MHS Approach	126.200	RCAG MHS	SAT
12	MHS Approach	126.200	RCAG MHS	DDN
13	All	121.500	Emergency	FIBER
14	All	243.000	Emergency	FIBER
15	Spare 1	Spare 1	Local Main	FIBER
16	Spare 1	Spare 1	Local Stby	FIBER
17	Spare 2	Spare 2	Local Main	FIBER
18	Spare 2	Spare 2	Local Stby	FIBER
19	Spare 3	Spare 3	Local Main	FIBER
20	Spare 3	Spare 3	Local Stby	FIBER

APPENDIX 3.3.9 : Hatyai CONTRA Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Approach	126.700	Local Main	FIBER
2	Approach	126.700	Local Stby	FIBER
3	Approach	301.500	Local Main	FIBER
4	NTW Approach	125.550	Local Main	FIBER
5	NTW Approach	125.550	RCAG NTW	SAT
6	NTW Approach	125.550	RCAG NTW	DDN,F/R
7	NTW Approach	284.000	RCAG NTW	SAT
8	TRN Approach	125.300	RCAG TRN	SAT
9	TRN Approach	125.300	RCAG TRN	DDN,F/R
10	PT Approach	126.000	RCAG PT	SAT
11	PT Approach	126.000	RCAG PT	DDN,F/R
12	All	121.450	BACKUP	FIBER
13	All	121.500	Emergency	FIBER
14	All	243.000	Emergency	FIBER
15	Spare 1	Spare 1	Local Main	FIBER
16	Spare 1	Spare 1	Local Stby	FIBER
17	Spare 2	Spare 2	Local Main	FIBER
18	Spare 2	Spare 2	Local Stby	FIBER
19	Spare 3	Spare 3	Local Main	FIBER
20	Spare 3	Spare 3	Local Stby	FIBER

APPENDIX 3.3.10 : Phuket CONTRA Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Approach	124.700	Local Main	FIBER
2	Approach	124.700	Local Stby	FIBER
3	Approach	284.000	Local Main	FIBER
4	Approach	284.000	Local Stby	FIBER
5	Approach	120.700	Local Main	FIBER
6	Approach	120.700	Local Stby	FIBER
7	KBI Approach	120.050	Local Main	DDN
8	KBI Approach	120.050	RCAG KBI	F/R
9	KBI Approach	120.050	RCAG KBI	SAT
10	RAN Approach	125.100	RCAG RAN	F/R
11	RAN Approach	125.100	RCAG RAN	SAT
12	All	122.450	BACKUP	FIBER
13	All	121.500	Emergency	FIBER
14	All	243.000	Emergency	FIBER
15	Spare 1	Spare 1	Local Main	FIBER
16	Spare 1	Spare 1	Local Stby	FIBER
17	Spare 2	Spare 2	Local Main	FIBER
18	Spare 2	Spare 2	Local Stby	FIBER
19	Spare 3	Spare 3	Local Main	FIBER
20	Spare 3	Spare 3	Local Stby	FIBER

APPENDIX 3.3.11 : Phitsanulok CONTRA Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Approach	120.700	Local Main	Copper
2	Approach	120.700	Local Stby	Copper
3	Approach	284.000	Local Main	Copper
4	Approach	284.000	Local Stby	Copper
5	TAK Approach	126.000	RCAG TAK	SAT
6	TAK Approach	126.000	RCAG TAK	F/R
7	All	119.450	BACKUP Main	Copper
8	All	119.450	BACKUP Stby	Copper
9	All	121.500	Emergency	Copper
10	All	121.500	Emergency	Copper
11	All	243.000	Emergency	Copper
12	All	243.000	Emergency	Copper
13	Approach	132.050	Flight Check Main	Copper
14	Approach	132.050	Flight Check Main	Copper
15	Spare 1	Spare 1	Local Main	Copper
16	Spare 1	Spare 1	Local Stby	Copper
17	Spare 2	Spare 2	Local Main	Copper
18	Spare 2	Spare 2	Local Stby	Copper
19	Spare 3	Spare 3	Local Main	Copper
20	Spare 3	Spare 3	Local Stby	Copper

APPENDIX 3.3.12 : Huahin Main CONTRA Radio Channels Capacity

Channel	Working Position	Frequency (MHz)	Connect to	MEDIA
1	Approach	126.200	Local Main	Copper
2	Approach	126.200	Local Stby	Copper
3	Approach	236.600	Local Main	Copper
4	Approach	236.600	Local Stby	Copper
5	Area	120.500	Offsite	Copper
6	Area	VHF	S1_Upper	Copper
7	All	133.000	BACKUP Main	Copper
8	All	133.000	BACKUP Stby	Copper
9	All	121.500	Emergency	Copper
10	All	121.500	Emergency	Copper
11	All	243.000	Emergency	Copper
12	All	243.000	Emergency	Copper
13	Approach	132.050	Flight Check Main	Copper
14	Approach	132.050	Flight Check Main	Copper
15	All	Spare 1	Local Main	Copper
16	All	Spare 1	Local Stby	Copper
17	All	Spare 2	Local Main	Copper
18	All	Spare 2	Local Stby	Copper
19	All	Spare 3	Local Main	Copper
20	All	Spare 3	Local Stby	Copper

APPENDIX 3.4 : Headsets and Handsets (provided and modification work)

Location	Main and Fallback System		CONTRA	
	Provided	Modify	Provided	Modify
Tungmahamek	Equal to Provided Working Positions	200 sets	Equal to Provided Working Positions	20 sets
Chiangmai	Equal to Provided Working Positions	12 sets	Equal to Provided Working Positions	8 sets
Hatyai	Equal to Provided Working Positions	50 sets	Equal to Provided Working Positions	8 sets
Phuket	Equal to Provided Working Positions	18 sets	Equal to Provided Working Positions	8 sets
Phitsanulok	Equal to Provided Working Positions	38 sets	Equal to Provided Working Positions	8 sets
Huahin	Equal to Provided Working Positions	45 sets	Equal to Provided Working Positions	5 sets

Remark : Modify only Headset

3.5 Recording Channels capacity of each site.

APPENDIX 3.5.1 : Tungmahamek Main (Fallback) Voice Record Channels Capacity
(at least 464ch/recorder)

Channel	CH Name	Detail	Connect to
1	EC1	Area	Position Record
2	PC1	Area	Position Record
3	EC2	Area	Position Record
4	PC2	Area	Position Record
5	EC3	Area	Position Record
6	PC3	Area	Position Record
7	EC4	Area	Position Record
8	PC4	Area	Position Record
9	EC5	Area	Position Record
10	PC5	Area	Position Record
11	EC6	Area	Position Record
12	PC6	Area	Position Record
13	EC7	Area	Position Record
14	PC7	Area	Position Record
15	EC8	Area	Position Record
16	PC8	Area	Position Record
17	EC9	Area	Position Record
18	PC9	Area	Position Record
19	EC10	Area	Position Record
20	PC10	Area	Position Record
21	EC11	Area	Position Record
22	PC11	Area	Position Record
23	EC12	Area	Position Record
24	PC12	Area	Position Record
25	EC13	Area	Position Record
26	PC13	Area	Position Record
27	EC14	Area	Position Record
28	PC14	Area	Position Record
29	EC15	Area	Position Record
30	PC15	Area	Position Record
31	EC16	Area	Position Record
32	PC16	Area	Position Record
33	TACTSUP1	Area	Position Record
34	TACTSUP2	Area	Position Record
35	TACTSUP3	Area	Position Record
36	EC1	Approach	Position Record
37	PC1	Approach	Position Record
38	EC2	Approach	Position Record
39	PC2	Approach	Position Record
40	EC3	Approach	Position Record
41	PC3	Approach	Position Record
42	EC4	Approach	Position Record
43	PC4	Approach	Position Record
44	EC5	Approach	Position Record
45	PC5	Approach	Position Record
46	EC6	Approach	Position Record
47	PC6	Approach	Position Record
48	TACTSUP	Approach	Position Record

Channel	CH Name	Detail	Connect to
49	OPSUP	Operation	Position Record
50	TECHSUP	Operation	Position Record
51	ASM	Operation	Position Record
52	CMAC	Pre-tactical	Position Record
53	EO1	Maint	Position Record
54	EO2	Maint	Position Record
55	MTN1	Maint	Position Record
56	MTN2	Maint	Position Record
57	TACTSUP*	Area (Option)	Position Record
58	AMAN1*	Area (Option)	Position Record
59	AMAN2*	Area (Option)	Position Record
60	AMAN3*	Area (Option)	Position Record
61	EC7*	Approach (Option)	Position Record
62	PC7*	Approach (Option)	Position Record
63	EC8*	Approach (Option)	Position Record
64	PC8*	Approach (Option)	Position Record
65	EC9*	Approach (Option)	Position Record
66	PC9*	Approach (Option)	Position Record
67	EC10*	Approach (Option)	Position Record
68	PC10*	Approach (Option)	Position Record
69	AMAN1*	Approach (Option)	Position Record
70	AMAN2*	Approach (Option)	Position Record
71	FISL1*	Operation (Option)	Position Record
72	FISL2*	Operation (Option)	Position Record
73	FISL3*	Operation (Option)	Position Record
74	FISL4*	Operation (Option)	Position Record
75	ASM*	Operation (Option)	Position Record
76	FM1*	Pre-tactical (Option)	Position Record
77	FM2*	Pre-tactical (Option)	Position Record
78	FM3*	Pre-tactical (Option)	Position Record
79	ATFM*	Pre-tactical (Option)	Position Record
80	SPARE POSITION	SPARE	Position Record
81	120.5	Local Main	Radio Channel Record
82	120.5	Local Stby	Radio Channel Record
83	120.5	KMN RCAG	Radio Channel Record
84	120.5	KMN RCAG	Radio Channel Record
85	120.5	HHN RCAG	Radio Channel Record
86	256.6	Local Main	Radio Channel Record
87	256.6	Local Stby	Radio Channel Record
88	256.6	KMN RCAG	Radio Channel Record
89	256.6	KMN RCAG	Radio Channel Record
90	VHF	HHN RCAG	Radio Channel Record
91	VHF	HHN RCAG	Radio Channel Record
92	UHF	HHN RCAG	Radio Channel Record
93	UHF	HHN RCAG	Radio Channel Record
94	133.3	CPN RCAG	Radio Channel Record
95	133.3	CPN RCAG	Radio Channel Record
96	133.3	SMU RCAG	Radio Channel Record
97	133.1	Local Main	Radio Channel Record
98	133.1	Local Stby	Radio Channel Record
99	133.1	KKN RCAG	Radio Channel Record

Channel	CH Name	Detail	Connect to
100	133.1	KKN RCAG	Radio Channel Record
101	133.1	UBL RCAG	Radio Channel Record
102	133.1	UBL RCAG	Radio Channel Record
103	133.1	KRT RCAG	Radio Channel Record
104	133.1	KRT RCAG	Radio Channel Record
105	133.1	BRM RCAG	Radio Channel Record
106	285.3	Local Main	Radio Channel Record
107	285.3	Local Stby	Radio Channel Record
108	285.3	KKN RCAG	Radio Channel Record
109	285.3	KKN RCAG	Radio Channel Record
110	285.3	UBL RCAG	Radio Channel Record
111	285.3	UBL RCAG	Radio Channel Record
112	285.3	KRT RCAG	Radio Channel Record
113	285.3	KRT RCAG	Radio Channel Record
114	135.5	Local Main	Radio Channel Record
115	135.5	Local Stby	Radio Channel Record
116	135.5	KMN RCAG	Radio Channel Record
117	135.5	KMN RCAG	Radio Channel Record
118	135.5	TRAT RCAG	Radio Channel Record
119	285.5	Local Main	Radio Channel Record
120	285.5	Local Stby	Radio Channel Record
121	285.5	KMN RCAG	Radio Channel Record
122	285.5	KMN RCAG	Radio Channel Record
123	128.1	Local Main	Radio Channel Record
124	128.1	Local Stby	Radio Channel Record
125	128.1	NSW RCAG	Radio Channel Record
126	128.1	NSW RCAG	Radio Channel Record
127	128.1	PSL RCAG	Radio Channel Record
128	128.1	KKN RCAG	Radio Channel Record
129	128.1	KKN RCAG	Radio Channel Record
130	263.8	Local Main	Radio Channel Record
131	263.8	Local Stby	Radio Channel Record
132	263.8	NSW RCAG	Radio Channel Record
133	263.8	NSW RCAG	Radio Channel Record
134	263.8	KKN RCAG	Radio Channel Record
135	263.8	KKN RCAG	Radio Channel Record
136	122.05	Local Main	Radio Channel Record
137	122.05	Local Stby	Radio Channel Record
138	122.05	KAN (RTAF) RCAG	Radio Channel Record
139	122.05	KAN (RTAF) RCAG	Radio Channel Record
140	122.05	KAN (TOT) RCAG	Radio Channel Record
141	UHF	Local Main	Radio Channel Record
142	UHF	Local Stby	Radio Channel Record
143	UHF	KAN (RTAF) RCAG	Radio Channel Record
144	UHF	KAN (RTAF) RCAG	Radio Channel Record
145	125.7	SMU RCAG	Radio Channel Record
146	125.7	SMU RCAG	Radio Channel Record
147	125.7	CPN RCAG	Radio Channel Record
148	125.7	PUT RCAG	Radio Channel Record
149	125.7	PUT RCAG	Radio Channel Record
150	268.5	SMU RCAG	Radio Channel Record

Channel	CH Name	Detail	Connect to
151	268.5	SMU RCAG	Radio Channel Record
152	268.5	PUT RCAG	Radio Channel Record
153	268.5	PUT RCAG	Radio Channel Record
154	121.5	Emergency SMU RCAG	Radio Channel Record
155	VHF	SRT RCAG	Radio Channel Record
156	VHF	SRT RCAG	Radio Channel Record
157	UHF	SRT RCAG	Radio Channel Record
158	UHF	SRT RCAG	Radio Channel Record
159	123.95	SMU RCAG	Radio Channel Record
160	123.95	SMU RCAG	Radio Channel Record
161	123.95	NKS RCAG	Radio Channel Record
162	123.95	HTY RCAG	Radio Channel Record
163	123.95	HTY RCAG	Radio Channel Record
164	265.9	SMU RCAG	Radio Channel Record
165	265.9	SMU RCAG	Radio Channel Record
166	265.9	HTY RCAG	Radio Channel Record
167	265.9	HTY RCAG	Radio Channel Record
168	121.5	Emergency SMU RCAG	Radio Channel Record
169	132.1	DOI RCAG	Radio Channel Record
170	132.1	DOI RCAG	Radio Channel Record
171	132.1	LPN RCAG	Radio Channel Record
172	132.1	UDN RCAG	Radio Channel Record
173	132.1	UDN RCAG	Radio Channel Record
174	132.1	LOI RCAG	Radio Channel Record
175	246.5	DOI RCAG	Radio Channel Record
176	246.5	DOI RCAG	Radio Channel Record
177	246.5	UDN RCAG	Radio Channel Record
178	246.5	UDN RCAG	Radio Channel Record
179	121.5	Emergency INT RCAG	Radio Channel Record
180	121.5	Emergency UDN RCAG	Radio Channel Record
181	VHF	UDN RCAG	Radio Channel Record
182	VHF	UDN RCAG	Radio Channel Record
183	VHF	LOY RCAG	Radio Channel Record
184	VHF	LOY RCAG	Radio Channel Record
185	UHF	UDN RCAG	Radio Channel Record
186	UHF	UDN RCAG	Radio Channel Record
187	UHF	LOY RCAG	Radio Channel Record
188	UHF	LOY RCAG	Radio Channel Record
189	133.9	KKN RCAG	Radio Channel Record
190	133.9	KKN RCAG	Radio Channel Record
191	133.9	UBL RCAG	Radio Channel Record
192	133.9	UBL RCAG	Radio Channel Record
193	133.9	ROI RCAG	Radio Channel Record
194	268.5	KKN RCAG	Radio Channel Record
195	268.5	KKN RCAG	Radio Channel Record
196	268.5	UBL RCAG	Radio Channel Record
197	268.5	UBL RCAG	Radio Channel Record
198	121.5	Emergency UBL RCAG	Radio Channel Record
199	121.5	Emergency Local Main	Radio Channel Record
200	121.5	Emergency Local Stby	Radio Channel Record
201	243.0	Emergency Local Main	Radio Channel Record

Channel	CH Name	Detail	Connect to
202	243.0	Emergency Local Stby	Radio Channel Record
203	132.05	F/C Main1	Radio Channel Record
204	132.05	F/C Stby1	Radio Channel Record
205	124.1	F/C Main2	Radio Channel Record
206	124.1	F/C Stby2	Radio Channel Record
207	122.75	Backup 1 Main	Radio Channel Record
208	122.75	Backup 1 Stby	Radio Channel Record
209	120.5,133.1,135.5,128.1	DM Backup 1	Radio Channel Record
210	120.5,133.1,135.5,128.1	DM Backup 2	Radio Channel Record
211	120.5,133.1,135.5,128.1	DM Backup 3	Radio Channel Record
212	120.5,133.1,135.5,128.1	DM Backup 4	Radio Channel Record
213	120.5,133.1,135.5,128.1	SB Backup 1	Radio Channel Record
214	120.5,133.1,135.5,128.1	SB Backup 2	Radio Channel Record
215	120.5,133.1,135.5,128.1	SB Backup 3	Radio Channel Record
216	120.5,133.1,135.5,128.1	SB Backup 4	Radio Channel Record
217	120.5,133.1,135.5,128.1	SB Backup 5	Radio Channel Record
218	120.5,133.1,135.5,128.1	SB Backup 6	Radio Channel Record
219	125.7,123.95	SMU Backup 1	Radio Channel Record
220	125.7,123.95	SMU Backup 2	Radio Channel Record
221	120.5,135.5	KMN Backup	Radio Channel Record
222	133.1,133.9	UBL Backup	Radio Channel Record
223	120.8	CDC SB Main	Radio Channel Record
224	120.8	CDC SB Stby	Radio Channel Record
225	133.8	CDC SB Main	Radio Channel Record
226	133.8	CDC SB Stby	Radio Channel Record
227	135.8	CDC SB Main	Radio Channel Record
228	135.8	CDC SB Stby	Radio Channel Record
229	128.7	CDC SB Main	Radio Channel Record
230	128.7	CDC SB Stby	Radio Channel Record
231	123.4	KKN APP RCAG	Radio Channel Record
232	123.4	KKN APP RCAG	Radio Channel Record
233	240.0	KKN APP RCAG	Radio Channel Record
234	240.0	KKN APP RCAG	Radio Channel Record
235	123.35	SKN APP RCAG	Radio Channel Record
236	123.35	SKN APP RCAG	Radio Channel Record
237	284.0	SKN APP RCAG	Radio Channel Record
238	284.0	SKN APP RCAG	Radio Channel Record
239	126.2	UDN APP RCAG	Radio Channel Record
240	126.2	UDN APP RCAG	Radio Channel Record
241	268.5	UDN APP RCAG	Radio Channel Record
242	268.5	UDN APP RCAG	Radio Channel Record
243	122.55	LOY APP RCAG	Radio Channel Record
244	122.55	LOY APP RCAG	Radio Channel Record
245	240.0	LOY APP RCAG	Radio Channel Record
246	240.0	LOY APP RCAG	Radio Channel Record
247	123.5	UBL APP RCAG	Radio Channel Record
248	123.5	UBL APP RCAG	Radio Channel Record
249	257.8	UBL APP RCAG	Radio Channel Record
250	257.8	UBL APP RCAG	Radio Channel Record
251	125.4	ROT APP RCAG	Radio Channel Record
252	125.4	ROT APP RCAG	Radio Channel Record

Channel	CH Name	Detail	Connect to
253	UHF	ROT APP RCAG	Radio Channel Record
254	UHF	ROT APP RCAG	Radio Channel Record
255	123.6	KRT APP RCAG	Radio Channel Record
256	123.6	KRT APP RCAG	Radio Channel Record
257	UHF	KRT APP RCAG	Radio Channel Record
258	UHF	KRT APP RCAG	Radio Channel Record
259	119.45	BRM APP RCAG	Radio Channel Record
260	119.45	BRM APP RCAG	Radio Channel Record
261	UHF	BRM APP RCAG	Radio Channel Record
262	UHF	BRM APP RCAG	Radio Channel Record
263	129.6	SMU APP RCAG (Airport)	Radio Channel Record
264	305.4	SMU APP RCAG (Airport)	Radio Channel Record
265	129.6	SMU APP RCAG (Khaophom)	Radio Channel Record
266	129.6	SMU APP RCAG (Khaophom)	Radio Channel Record
267	305.4	SMU APP RCAG (Khaophom)	Radio Channel Record
268	305.4	SMU APP RCAG (Khaophom)	Radio Channel Record
269	119.75	NKS APP RCAG	Radio Channel Record
270	119.75	NKS APP RCAG	Radio Channel Record
271	UHF	NKS APP RCAG	Radio Channel Record
272	UHF	NKS APP RCAG	Radio Channel Record
273	123.35	STN APP RCAG	Radio Channel Record
274	123.35	STN APP RCAG	Radio Channel Record
275	240.0	STN APP RCAG	Radio Channel Record
276	240.0	STN APP RCAG	Radio Channel Record
277	118.6	TRAT APP RCAG	Radio Channel Record
278	118.6	TRAT APP RCAG	Radio Channel Record
279	UHF	TRAT APP RCAG	Radio Channel Record
280	UHF	TRAT APP RCAG	Radio Channel Record
281	120.05	CTR APP RCAG	Radio Channel Record
282	120.05	CTR APP RCAG	Radio Channel Record
283	257.8	CTR APP RCAG	Radio Channel Record
284	257.8	CTR APP RCAG	Radio Channel Record
285	120.25	NAN APP RCAG	Radio Channel Record
286	120.25	NAN APP RCAG	Radio Channel Record
287	UHF	NAN APP RCAG	Radio Channel Record
288	UHF	NAN APP RCAG	Radio Channel Record
289	120.1	PAE APP RCAG	Radio Channel Record
290	120.1	PAE APP RCAG	Radio Channel Record
291	UHF	PAE APP RCAG	Radio Channel Record
292	UHF	PAE APP RCAG	Radio Channel Record
293	126.7	PCB APP RCAG	Radio Channel Record
294	126.7	PCB APP RCAG	Radio Channel Record
295	UHF	PCB APP RCAG	Radio Channel Record
296	UHF	PCB APP RCAG	Radio Channel Record
297	VHF	RCAG	Radio Channel Record
298	VHF	RCAG	Radio Channel Record
299	VHF	RCAG	Radio Channel Record
300	VHF	RCAG	Radio Channel Record
301	VHF	RCAG	Radio Channel Record
302	VHF	RCAG	Radio Channel Record
303	VHF	RCAG	Radio Channel Record

Channel	CH Name	Detail	Connect to
304	VHF	RCAG	Radio Channel Record
305	VHF	RCAG	Radio Channel Record
306	VHF	RCAG	Radio Channel Record
307	VHF	RCAG	Radio Channel Record
308	VHF	RCAG	Radio Channel Record
309	VHF	RCAG	Radio Channel Record
310	VHF	RCAG	Radio Channel Record
311	VHF	RCAG	Radio Channel Record
312	VHF	RCAG	Radio Channel Record
313	VHF	RCAG	Radio Channel Record
314	VHF	RCAG	Radio Channel Record
315	VHF	RCAG	Radio Channel Record
316	VHF	RCAG	Radio Channel Record
317	VHF	RCAG	Radio Channel Record
318	VHF	RCAG	Radio Channel Record
319	VHF	RCAG	Radio Channel Record
320	VHF	RCAG	Radio Channel Record
321	VHF	Spare F1 Main	Radio Channel Record
322	VHF	Spare F1 Stby	Radio Channel Record
323	VHF	Spare F2 Main	Radio Channel Record
324	VHF	Spare F2 Stby	Radio Channel Record
325	VHF	Spare F3 Main	Radio Channel Record
326	VHF	Spare F3 Stby	Radio Channel Record
327	VHF	Spare F4 Main	Radio Channel Record
328	VHF	Spare F4 Stby	Radio Channel Record
329	VHF	Spare F5 Main	Radio Channel Record
330	VHF	Spare F5 Stby	Radio Channel Record
331	VHF	Spare F6 Main	Radio Channel Record
332	VHF	Spare F6 Stby	Radio Channel Record
333	VHF	Spare F7 Main	Radio Channel Record
334	VHF	Spare F7 Stby	Radio Channel Record
335	VHF	Spare F8 Main	Radio Channel Record
336	VHF	Spare F8 Stby	Radio Channel Record
337	VHF	Spare F9 Main	Radio Channel Record
338	VHF	Spare F9 Stby	Radio Channel Record
339	VHF	Spare F10 Main	Radio Channel Record
340	VHF	Spare F10 Stby	Radio Channel Record
341	APP_E1	Area	Record
342	APP_E2	Area	Record
343	APP_S	Area	Record
344	APP_W	Area	Record
345	APP_E1	Area	Record
346	APP_E2	Area	Record
347	APP_E1	Area	Record
348	APP_E2	Area	Record
349	APP_S	Area	Record
350	APP_E1	Area	Record
351	APP_E2	Area	Record
352	APP_N	Area	Record
353	APP_W	Area	Record
354	APP_N	Area	Record

Channel	CH Name	Detail	Connect to
355	APP_S	Area	Record
356	APP_W	Area	Record
357	FD	Area	Record
358	FDO	Area	Record
359	H/L SUP N	Area	Record
360	H/L SUP S	Area	Record
361	H/L SUP APP	Approach	Record
362	9120	CE.SE.	Record
363	9121	CE.SE.	Record
364	6794217	CE.SE.	Record
365	29106	CE.SE.	Record
366	9065	Area	Record
367	9111	Area	Record
368	9112	Area	Record
369	29105	Area	Record
370	5355991	Area	Record
371	2878456	Area	Record
372	2874391	Area	Record
373	9471	Area	Record
374	9472	Area	Record
375	9473	Area	Record
376	9474	Area	Record
377	9475	Area	Record
378	9476	Area	Record
379	9477	Area	Record
380	9478	Area	Record
381	9479*	Area	Record
382	9480*	Area	Record
383	9481*	Area	Record
384	9482*	Area	Record
385	9483*	Area	Record
386	9484*	Area	Record
387	9485*	Area	Record
388	9486*	Area	Record
389	02-287-4681	Area	Record
390	02-287-4682	Area	Record
391	02-287-4683	Area	Record
392	02-287-4684	Area	Record
393	02-287-4685	Area	Record
394	02-287-4686	Area	Record
395	02-287-4687	Area	Record
396	02-287-4688	Area	Record
397	02-287-4689*	Area	Record
398	02-287-4690*	Area	Record
399	02-287-4691*	Area	Record
400	02-287-4692*	Area	Record
401	02-287-4693*	Area	Record
402	02-287-4694*	Area	Record
403	02-287-4695*	Area	Record
404	02-287-4696*	Area	Record
405	ATS1	Area	Record

Channel	CH Name	Detail	Connect to
406	ATS2	Area	Record
407	ATS3	Area	Record
408	ATS4	Area	Record
409	ATS5	Area	Record
410	ATS6	Area	Record
411	ATS7	Area	Record
412	ATS8	Area	Record
413	ATS9*	Area	Record
414	ATS10*	Area	Record
415	ATS11*	Area	Record
416	ATS12*	Area	Record
417	ATS13*	Area	Record
418	ATS14*	Area	Record
419	ATS15*	Area	Record
420	ATS16*	Area	Record
421	2003	Approach	Record
422	2005	Approach	Record
423	2006	Approach	Record
424	2008	Approach	Record
425	20xx	Approach	Record
426	20xx	Approach	Record
427	8611	Approach	Record
428	8612	Approach	Record
429	8613	Approach	Record
430	8614	Approach	Record
431	86xx	Approach	Record
432	86xx	Approach	Record
433	9611	Approach	Record
434	9612	Approach	Record
435	9613	Approach	Record
436	9614	Approach	Record
437	9615	Approach	Record
438	96xx	Approach	Record
439	96xx	Approach	Record
440	9695	Approach	Record
441	Tel. 02-287-3181	Approach	Record
442	Tel. 02-286-0095	Approach	Record
443	Tel. 02-286-0199	Approach	Record
444	Tel. 02-286-0224	Approach	Record
445	Tel. 02-286-xxxx	Approach	Record
446	Tel. 02-286-xxxx	Approach	Record
447	Spare1	ALL	ALL
448	Spare2	ALL	ALL
449	Spare3	ALL	ALL
450	Spare4	ALL	ALL
451	Spare5	ALL	ALL
452	Spare6	ALL	ALL
453	Spare7	ALL	ALL
454	Spare8	ALL	ALL
455	Spare9	ALL	ALL
456	Spare10	ALL	ALL

Channel	CH Name	Detail	Connect to
457	Spare11	ALL	ALL
458	Spare12	ALL	ALL
459	Spare13	ALL	ALL
460	Spare14	ALL	ALL
461	Spare15	ALL	ALL
462	Spare16	ALL	ALL
463	Spare17	ALL	ALL
464	Spare18	ALL	ALL

APPENDIX 3.5.2 : Chiangmai Main (Fallback)Voice Record Channels Capacity
(at least 96ch/recorder)

Channel	CH Name	Detail	Remark
1	EC APP 1	Approach	Position Record
2	EC APP 2	Approach	Position Record
3	EC APP 3	Approach	Position Record
4	PC APP 1	Approach	Position Record
5	PC APP 2	Approach	Position Record
6	PC APP 3	Approach	Position Record
7	EC TWR 1	Tower	Position Record
8	EC TWR 2	Tower	Position Record
9	PC TWR 1	Tower	Position Record
10	PC TWR 2	Tower	Position Record
11	AMAN	Approach	Position Record
12	TS APP	Approach	Position Record
13	TS TWR	Tower	Position Record
14	MTN 1	Maint	Position Record
15	MTN 2	Maint	Position Record
16	SPARE 1	SPARE 1	Position Record
17	SPARE 2	SPARE 2	Position Record
18	SPARE 3	SPARE 3	Position Record
19	121.900	Ground	Radio Record
20	121.900	Ground	Radio Record
21	275.800	Ground	Radio Record
22	275.800	Ground	Radio Record
23	118.100	Local	Radio Record
24	118.100	Local	Radio Record
25	236.600	Local	Radio Record
26	236.600	Local	Radio Record
27	129.600	Approach	Radio Record
28	129.600	Approach	Radio Record
29	305.400	Approach	Radio Record
30	305.400	Approach	Radio Record
31	129.600	Approach	Radio Record
32	129.600	Approach	Radio Record
33	305.400	Approach	Radio Record
34	305.400	Approach	Radio Record
35	119.300	LPN Approach	Radio Record
36	119.300	LPN Approach	Radio Record
37	120.650	MST Approach	Radio Record
38	120.650	MST Approach	Radio Record
39	126.200	MHS Approach	Radio Record
40	126.200	MHS Approach	Radio Record
41	127.200	ATIS	Radio Record
42	301.500	ATIS	Radio Record
43	121.500	Emergency	Radio Record
44	121.500	Emergency	Radio Record
45	243.000	Emergency	Radio Record
46	243.000	Emergency	Radio Record
47	Flight Check	Approach	Radio Record
48	Radio Backup Tower	Backup	Radio Record

Channel	CH Name	Detail	Remark
49	Radio Backup Approach	Backup	Radio Record
50	BACC S4 (F/R)	Approach	Telephone Record
51	BACC S4 (SAT)	Approach	Telephone Record
52	BACC S7 (F/R)	Approach	Telephone Record
53	BACC S7 (SAT)	Approach	Telephone Record
54	2603 ATS	Approach	Telephone Record
55	2605 ATS	Approach	Telephone Record
56	2611 ATS	Approach	Telephone Record
57	6760 ATS	Approach	Telephone Record
58	57507 RTAF	Approach	Telephone Record
59	57521 RTAF	Approach	Telephone Record
60	02-3034028	Approach	Telephone Record
61	4812	Tower	Telephone Record
62	4813	Tower	Telephone Record
63	4817	Tower	Telephone Record
64	4818	Approach	Telephone Record
65	4199	Approach	Telephone Record
66	4822	Approach	Telephone Record
67	4833	Approach	Telephone Record
68	4835	Approach	Telephone Record
69	2W-PABX	Approach	Telephone Record
70	277776	Approach	Telephone Record
71	INTERCOM (APP <--> TWR)	All	Telephone Record
72	Hotline AOT)	All	Telephone Record
73	TEL. Crash Phone Wing411	All	Telephone Record
74	MET	All	Telephone Record
75	AOT	All	Telephone Record
76	FIRE	All	Telephone Record
77	SPARE 1	All	SPARE
78	SPARE 2	All	SPARE
79	SPARE 3	All	SPARE
80	SPARE 4	All	SPARE
81	SPARE 5	All	SPARE
82	SPARE 6	All	SPARE
83	SPARE 7	All	SPARE
84	SPARE 8	All	SPARE
85	SPARE 9	All	SPARE
86	SPARE 10	All	SPARE
87	SPARE 11	All	SPARE
88	SPARE 12	All	SPARE
89	SPARE 13	All	SPARE
90	SPARE 14	All	SPARE
91	SPARE 15	All	SPARE
92	SPARE 16	All	SPARE
93	SPARE 17	All	SPARE
94	SPARE 18	All	SPARE
95	SPARE 19	All	SPARE
96	SPARE 20	All	SPARE

APPENDIX 3.5.3 : Hatyai Main (Fallback) Voice Record Channels Capacity**(at least 96ch/recorder)**

Channel	CH Name	Detail	Remark
1	EC APP 1	Approach	Position Record
2	EC APP 2	Approach	Position Record
3	EC APP 3	Approach	Position Record
4	PC APP 1	Approach	Position Record
5	PC APP 2	Approach	Position Record
6	PC APP 3	Approach	Position Record
7	EC TWR 1	Tower	Position Record
8	EC TWR 2	Tower	Position Record
9	PC TWR 1	Tower	Position Record
10	PC TWR 2	Tower	Position Record
11	AMAN	Approach	Position Record
12	TS APP	Approach	Position Record
13	TS TWR	Tower	Position Record
14	MTN 1	Maint	Position Record
15	MTN 2	Maint	Position Record
16	SPARE 1	SPARE 1	Position Record
17	SPARE 2	SPARE 2	Position Record
18	SPARE 3	SPARE 3	Position Record
19	121.900	Ground	Radio Record
20	121.900	Ground	Radio Record
21	257.800	Ground	Radio Record
22	257.800	Ground	Radio Record
23	118.100	Local	Radio Record
24	118.100	Local	Radio Record
25	275.800	Local	Radio Record
26	275.800	Local	Radio Record
27	126.700	Approach	Radio Record
28	126.700	Approach	Radio Record
29	301.500	Approach	Radio Record
30	301.500	Approach	Radio Record
31	125.550	NTW Approach	Radio Record
32	125.550	NTW Approach	Radio Record
33	125.550	NTW Approach	Radio Record
34	284.000	NTW Approach	Radio Record
35	284.000	NTW Approach	Radio Record
36	125.300	TRN Approach	Radio Record
37	125.300	TRN Approach	Radio Record
38	125.300	TRN Approach	Radio Record
39	126.000	PT Approach	Radio Record
40	126.000	PT Approach	Radio Record
41	126.000	PT Approach	Radio Record
42	128.800	ATIS	Radio Record
43	133.300	BACKUP	Radio Record
44	121.500	Emergency	Radio Record
45	121.500	Emergency	Radio Record
46	243.000	Emergency	Radio Record
47	243.000	Emergency	Radio Record
48	132.050	Approach	Radio Record

Channel	CH Name	Detail	Remark
49	Radio Backup Tower	Tower	Radio Record
50	Radio Backup Approach	Approach	Radio Record
51	BACC S5 (F/R)	Approach	Telephone Record
52	BACC S5 (SAT)	Approach	Telephone Record
53	BACC S6 (F/R)	Approach	Telephone Record
54	BACC S6 (SAT)	Approach	Telephone Record
55	SMU APP	Approach	Telephone Record
56	PUT APP	Approach	Telephone Record
57	KRABI APP	Approach	Telephone Record
58	NTW TWR	Approach	Telephone Record
59	TRN TWR	Approach	Telephone Record
60	PT TWR	Approach	Telephone Record
61	SKL TWR	Approach	Telephone Record
62	BTW	Approach	Telephone Record
63	RONDA1	Approach	Telephone Record
64	RONDA2	Approach	Telephone Record
65	SRT 63523	Approach	Telephone Record
66	SRT 63525	Approach	Telephone Record
67	TEL. 6812	Tower	Telephone Record
68	TEL. 6813	Tower	Telephone Record
69	TEL. 6817	Approach	Telephone Record
70	TEL. 6818	Approach	Telephone Record
71	TEL. 6833	Approach	Telephone Record
72	TEL. 251-073	Approach	Telephone Record
73	TEL. 251-074	Approach	Telephone Record
74	TEL. 474-570	Approach	Telephone Record
75	TEL. 474-572	Approach	Telephone Record
76	FIRE	All	Telephone Record
77	AOT	All	Telephone Record
78	SPARE 1	All	SPARE
79	SPARE 2	All	SPARE
80	SPARE 3	All	SPARE
81	SPARE 4	All	SPARE
82	SPARE 5	All	SPARE
83	SPARE 6	All	SPARE
84	SPARE 7	All	SPARE
85	SPARE 8	All	SPARE
86	SPARE 9	All	SPARE
87	SPARE 10	All	SPARE
88	SPARE 11	All	SPARE
89	SPARE 12	All	SPARE
90	SPARE 13	All	SPARE
91	SPARE 14	All	SPARE
92	SPARE 15	All	SPARE
93	SPARE 16	All	SPARE
94	SPARE 17	All	SPARE
95	SPARE 18	All	SPARE
96	SPARE 19	All	SPARE

APPENDIX 3.5.4 : Phuket Main (Fallback) Voice Record Channels Capacity**(at least 96ch/recorder)**

Channel	CH Name	Detail	Remark
1	EC APP 1	Approach	Position Record
2	EC APP 2	Approach	Position Record
3	EC APP 3	Approach	Position Record
4	PC APP 1	Approach	Position Record
5	PC APP 2	Approach	Position Record
6	PC APP 3	Approach	Position Record
7	EC TWR 1	Tower	Position Record
8	EC TWR 2	Tower	Position Record
9	PC TWR 1	Tower	Position Record
10	PC TWR 2	Tower	Position Record
11	AMAN	Approach	Position Record
12	TS APP	Approach	Position Record
13	TS TWR	Tower	Position Record
14	MTN 1	Maint	Position Record
15	MTN 2	Maint	Position Record
16	SPARE 1	SPARE 1	Position Record
17	SPARE 2	SPARE 2	Position Record
18	SPARE 3	SPARE 3	Position Record
19	121.900	Ground	Radio Record
20	121.900	Ground	Radio Record
21	UHF	Ground	Radio Record
22	UHF	Ground	Radio Record
23	118.100	Local	Radio Record
24	118.100	Local	Radio Record
25	236.600	Local	Radio Record
26	236.600	Local	Radio Record
27	124.700	Approach	Radio Record
28	124.700	Approach	Radio Record
29	284.000	Approach	Radio Record
30	284.000	Approach	Radio Record
31	120.700	Approach	Radio Record
32	120.700	Approach	Radio Record
33	120.050	KBI Approach	Radio Record
34	120.050	KBI Approach	Radio Record
35	120.050	KBI Approach	Radio Record
36	125.100	RAN Approach	Radio Record
37	125.100	RAN Approach	Radio Record
38	128.000	ATIS	Radio Record
39	122.450	BACKUP	Radio Record
40	121.500	Emergency	Radio Record
41	121.500	Emergency	Radio Record
42	243.000	Emergency	Radio Record
43	243.000	Emergency	Radio Record
44	132.050	Approach	Radio Record
45	APP PUT SUB1	Approach	Radio Record
46	APP PUT SUB1	Approach	Radio Record
47	APP PUT SUB2	Approach	Radio Record
48	APP PUT SUB2	Approach	Radio Record

Channel	CH Name	Detail	Remark
49	CDC	Approach	Radio Record
50	CDC	Approach	Radio Record
51	Radio Backup Tower	Tower	Radio Record
52	Radio Backup Approach	Approach	Radio Record
53	Briefing	All	Telephone Record
54	BACC S5 (TOT)	Approach	Telephone Record
55	BACC S5 (F/R)	Approach	Telephone Record
56	BACC S6 (TOT)	Approach	Telephone Record
57	BACC S6 (F/R)	Approach	Telephone Record
58	BACC S5_KBI (SAT)	Approach	Telephone Record
59	BACC S5_KBI (F/R)	Approach	Telephone Record
60	SMU APP	Approach	Telephone Record
61	HTY APP	Approach	Telephone Record
62	KBI TWR (F/R)	Approach	Telephone Record
63	KBI TWR (SAT)	Approach	Telephone Record
64	RAN TWR (F/R)	Approach	Telephone Record
65	RAN TWR (SAT)	Approach	Telephone Record
66	BGS	Approach	Telephone Record
67	SWALLO	Approach	Telephone Record
68	TEL. 5812	Tower	Telephone Record
69	TEL. 5813	Tower	Telephone Record
70	TEL. 5814	Tower	Telephone Record
71	TEL. 5818	Approach	Telephone Record
72	TEL. 5819	Approach	Telephone Record
73	TEL. 5820	Approach	Telephone Record
74	TEL. 327-195	Tower	Telephone Record
75	TEL. 327-269	Tower	Telephone Record
76	Crash phone 1	Tower	Telephone Record
77	Crash phone 2	Tower	Telephone Record
78	FIRE	All	Telephone Record
79	SPARE 1	All	SPARE
80	SPARE 2	All	SPARE
81	SPARE 3	All	SPARE
82	SPARE 4	All	SPARE
83	SPARE 5	All	SPARE
84	SPARE 6	All	SPARE
85	SPARE 7	All	SPARE
86	SPARE 8	All	SPARE
87	SPARE 9	All	SPARE
88	SPARE 10	All	SPARE
89	SPARE 11	All	SPARE
90	SPARE 12	All	SPARE
91	SPARE 13	All	SPARE
92	SPARE 14	All	SPARE
93	SPARE 15	All	SPARE
94	SPARE 16	All	SPARE
95	SPARE 17	All	SPARE
96	SPARE 18	All	SPARE

APPENDIX 3.5.5 : Phitsanulok Main (Fallback) Voice Record Channels Capacity			
(at least 72ch/recorder)			
Channel	CH Name	Detail	Remark
1	EC APP 1	Approach	Position Record
2	EC APP 2	Approach	Position Record
3	PC APP 1	Approach	Position Record
4	PC APP 2	Approach	Position Record
5	EC TWR 1	Tower	Position Record
6	EC TWR 2	Tower	Position Record
7	PC TWR 1	Tower	Position Record
8	PC TWR 2	Tower	Position Record
9	TS APP	Approach	Position Record
10	TS TWR	Tower	Position Record
11	MTN 1	Maint	Position Record
12	MTN 2	Maint	Position Record
13	SPARE 1	SPARE 1	Position Record
14	SPARE 2	SPARE 2	Position Record
15	SPARE 3	SPARE 3	Position Record
16	121.900	Ground	Radio Record
17	121.900	Ground	Radio Record
18	118.900	Local	Radio Record
19	118.900	Local	Radio Record
20	236.600	Local	Radio Record
21	236.600	Local	Radio Record
22	120.700	Approach	Radio Record
23	120.700	Approach	Radio Record
24	284.000	Approach	Radio Record
25	284.000	Approach	Radio Record
26	126.000	TAK Approach	Radio Record
27	126.000	TAK Approach	Radio Record
28	119.450	BACKUP	Radio Record
29	119.450	BACKUP	Radio Record
30	121.500	Emergency	Radio Record
31	121.500	Emergency	Radio Record
32	243.000	Emergency	Radio Record
33	243.000	Emergency	Radio Record
34	132.050	Approach	Radio Record
35	132.050	Approach	Radio Record
36	Spare 1	All	Radio Record
37	Spare 1	All	Radio Record
38	Spare 2	All	Radio Record
39	Spare 2	All	Radio Record
40	Radio Backup Tower	Tower	Radio Record
41	Radio Backup Approach	Approach	Radio Record
42	Briefing	All	Telephone Record
43	BACC S4	Approach	Telephone Record
44	BACC S7	Approach	Telephone Record
45	TAK TWR	Approach	Telephone Record
46	SKT TWR	Approach	Telephone Record
47	CTR APP	Approach	Telephone Record
48	ATS 6709	Approach	Telephone Record

Channel	CH Name	Detail	Remark
49	ATS 7709	Approach	Telephone Record
50	ATS 7715	Approach	Telephone Record
51	ATS 7010	Approach	Telephone Record
52	ATS 7016	Approach	Telephone Record
53	H//L Dora	Approach	Telephone Record
54	ICS 55988	Approach	Telephone Record
55	TEL. 7000	Approach	Telephone Record
56	TEL. 7015	Approach	Telephone Record
57	TEL. 7016	Approach	Telephone Record
58	TEL. 266-381	Approach	Telephone Record
59	TEL. 301-425	Approach	Telephone Record
60	MET	All	Telephone Record
61	DOA	All	Telephone Record
62	FIRE	All	Telephone Record
63	SPARE1	All	Telephone Record
64	SPARE2	All	Telephone Record
65	SPARE3	All	Telephone Record
66	SPARE4	All	Telephone Record
67	SPARE5	All	Telephone Record
68	SPARE6	All	Telephone Record
69	SPARE7	All	Telephone Record
70	SPARE8	All	Telephone Record
71	SPARE9	All	Telephone Record
72	SPARE10	All	Telephone Record

APPENDIX 3.5.6 : Huahin Main (Fallback)Voice Record Channels Capacity**(at least 72ch/recorder)**

Channel	CH Name	Detail	Remark
1	EC APP 1	Approach	Position Record
2	EC APP 2	Approach	Position Record
3	PC APP 1	Approach	Position Record
4	PC APP 2	Approach	Position Record
5	EC TWR 1	Tower	Position Record
6	EC TWR 2	Tower	Position Record
7	PC TWR 1	Tower	Position Record
8	PC TWR 2	Tower	Position Record
9	TS APP	Approach	Position Record
10	TS TWR	Tower	Position Record
11	MTN 1	Maint	Position Record
12	MTN 2	Maint	Position Record
13	SPARE 1	SPARE 1	Position Record
14	SPARE 2	SPARE 2	Position Record
15	SPARE 3	SPARE 3	Position Record
16	121.900	Ground	Radio Record
17	121.900	Ground	Radio Record
18	122.700	Local	Radio Record
19	122.700	Local	Radio Record
20	UHF	Local	Radio Record
21	UHF	Local	Radio Record
22	126.200	Approach	Radio Record
23	126.200	Approach	Radio Record
24	236.600	Approach	Radio Record
25	236.600	Approach	Radio Record
26	120.500	Area	Radio Record
27	VHF S1 Upper	Area	Radio Record
28	133.000	All	Radio Record
29	133.000	All	Radio Record
30	121.500	All	Radio Record
31	121.500	All	Radio Record
32	243.000	All	Radio Record
33	243.000	All	Radio Record
34	132.050	Approach	Radio Record
35	132.050	Approach	Radio Record
36	Spare 1	All	Telephone Record
37	Spare 1	All	Telephone Record
38	Spare 2	All	Telephone Record
39	Spare 2	All	Telephone Record
40	Spare 3	All	Telephone Record
41	Spare 3	All	Telephone Record
42	Spare 4	All	Telephone Record
43	Spare 4	All	Telephone Record
44	Spare 5	All	Telephone Record
45	Spare 5	All	Telephone Record
46	BACC_S1	Approach	Telephone Record
47	SBA	Approach	Telephone Record
48	ATS 2412	Approach	Telephone Record

Channel	CH Name	Detail	Remark
49	TEL. 5200	Tower	Telephone Record
50	TEL. 5201	Tower	Telephone Record
51	TEL. 5291	Approach	Telephone Record
52	TEL. 5292	Approach	Telephone Record
53	TEL. 5205	All	Telephone Record
54	TEL. 5206	All	Telephone Record
55	TEL. 520-830	All	Telephone Record
56	TEL. 522-097	All	Telephone Record
57	Wing 53	Approach	Telephone Record
58	MET	All	Telephone Record
59	KPS	Approach	Telephone Record
60	BUT	Approach	Telephone Record
61	DOA	All	Telephone Record
62	FIRE	All	Telephone Record
63	B/O	All	Telephone Record
64	H/L APP-TWR CH1	All	Telephone Record
65	H/L APP-TWR CH2	All	Telephone Record
66	SPARE1	All	Telephone Record
67	SPARE2	All	Telephone Record
68	SPARE3	All	Telephone Record
69	SPARE4	All	Telephone Record
70	SPARE5	All	Telephone Record
71	SPARE6	All	Telephone Record
72	SPARE7	All	Telephone Record

APPENDIX 3.5.7 : Tungmahamek CONTRA Voice Record Channels Capacity
(at least 224 ch/recorder)

Channel	CH Name	Detail	Connect to
1	D1	Area	Position Record
2	R1	Area	Position Record
3	D2	Area	Position Record
4	R2	Area	Position Record
5	D3	Area	Position Record
6	R3	Area	Position Record
7	D4	Area	Position Record
8	R4	Area	Position Record
9	D5	Area	Position Record
10	R5	Area	Position Record
11	D6	Area	Position Record
12	R6	Area	Position Record
13	D1	Area	Position Record
14	R1	Area	Position Record
15	D2	Area	Position Record
16	R2	Area	Position Record
17	D3	Area	Position Record
18	R3	Area	Position Record
19	D4	Area	Position Record
20	R4	Area	Position Record
21	A-man	Area	Position Record
22	A-man	Area	Position Record
23	FIS1	Area	Position Record
24	FIS2	Area	Position Record
25	OPSUP1	Area	Position Record
26	OPSUP2	Area	Position Record
27	OPSUP3	Area	Position Record
28	Tech SUP	Area	Position Record
29	TS1	Area	Position Record
30	TS2	Area	Position Record
31	TS3	Area	Position Record
32	CMAC	Area	Position Record
33	MAINT1	Area	Position Record
34	120.5	Local Main	Radio Channel Record
35	120.5	Local Stby	Radio Channel Record
36	120.5	KMN RCAG	Radio Channel Record
37	120.5	KMN RCAG	Radio Channel Record
38	120.5	HHN RCAG	Radio Channel Record
39	256.6	Local Main	Radio Channel Record
40	256.6	KMN RCAG	Radio Channel Record
41	133.1	Local Main	Radio Channel Record
42	133.1	Local Stby	Radio Channel Record
43	133.1	KKN RCAG	Radio Channel Record
44	133.1	KKN RCAG	Radio Channel Record
45	133.1	UBL RCAG	Radio Channel Record
46	133.1	UBL RCAG	Radio Channel Record
47	133.1	KRT RCAG	Radio Channel Record
48	133.1	KRT RCAG	Radio Channel Record

Channel	CH Name	Detail	Connect to
49	133.1	BRM RCAG	Radio Channel Record
50	285.3	Local Main	Radio Channel Record
51	285.3	KKN RCAG	Radio Channel Record
52	285.3	UBL RCAG	Radio Channel Record
53	285.3	KRT RCAG	Radio Channel Record
54	135.5	Local Main	Radio Channel Record
55	135.5	Local Stby	Radio Channel Record
56	135.5	KMN RCAG	Radio Channel Record
57	135.5	KMN RCAG	Radio Channel Record
58	135.5	TRAT RCAG	Radio Channel Record
59	285.5	Local Main	Radio Channel Record
60	285.5	KMN RCAG	Radio Channel Record
61	128.1	Local Main	Radio Channel Record
62	128.1	Local Stby	Radio Channel Record
63	128.1	NSW RCAG	Radio Channel Record
64	128.1	NSW RCAG	Radio Channel Record
65	128.1	PSL RCAG	Radio Channel Record
66	128.1	KKN RCAG	Radio Channel Record
67	128.1	KKN RCAG	Radio Channel Record
68	263.8	Local Main	Radio Channel Record
69	263.8	NSW RCAG	Radio Channel Record
70	263.8	KKN RCAG	Radio Channel Record
71	125.7	SMU RCAG	Radio Channel Record
72	125.7	SMU RCAG	Radio Channel Record
73	125.7	CPN RCAG	Radio Channel Record
74	125.7	PUT RCAG	Radio Channel Record
75	125.7	PUT RCAG	Radio Channel Record
76	268.5	SMU RCAG	Radio Channel Record
77	268.5	PUT RCAG	Radio Channel Record
78	121.5	Emergency SMU RCAG	Radio Channel Record
79	123.95	SMU RCAG	Radio Channel Record
80	123.95	SMU RCAG	Radio Channel Record
81	123.95	NKS RCAG	Radio Channel Record
82	123.95	HTY RCAG	Radio Channel Record
83	123.95	HTY RCAG	Radio Channel Record
84	265.9	SMU RCAG	Radio Channel Record
85	265.9	HTY RCAG	Radio Channel Record
86	132.1	DOI RCAG	Radio Channel Record
87	132.1	DOI RCAG	Radio Channel Record
88	132.1	LPN RCAG	Radio Channel Record
89	132.1	UDN RCAG	Radio Channel Record
90	132.1	UDN RCAG	Radio Channel Record
91	132.1	LOI RCAG	Radio Channel Record
92	246.5	DOI RCAG	Radio Channel Record
93	246.5	UDN RCAG	Radio Channel Record
94	121.5	Emergency INT RCAG	Radio Channel Record
95	121.5	Emergency UDN RCAG	Radio Channel Record
96	133.9	KKN RCAG	Radio Channel Record
97	133.9	KKN RCAG	Radio Channel Record
98	133.9	UBL RCAG	Radio Channel Record
99	133.9	UBL RCAG	Radio Channel Record

Channel	CH Name	Detail	Connect to
100	133.9	ROI RCAG	Radio Channel Record
101	268.5	KKN RCAG	Radio Channel Record
102	268.5	UBL RCAG	Radio Channel Record
103	121.5	Emergency UBL RCAG	Radio Channel Record
104	121.5	Emergency Local Main	Radio Channel Record
105	121.5	Emergency Local Stby	Radio Channel Record
106	243.0	Emergency Local Main	Radio Channel Record
107	120.5,135.5	KMN Backup	Radio Channel Record
108	133.1,133.9	UBL Backup	Radio Channel Record
109	120.8	CDC SB Main	Radio Channel Record
110	120.8	CDC SB Stby	Radio Channel Record
111	133.8	CDC SB Main	Radio Channel Record
112	133.8	CDC SB Stby	Radio Channel Record
113	135.8	CDC SB Main	Radio Channel Record
114	135.8	CDC SB Stby	Radio Channel Record
115	128.7	CDC SB Main	Radio Channel Record
116	128.7	CDC SB Stby	Radio Channel Record
117	123.4	KKN APP RCAG	Radio Channel Record
118	123.4	KKN APP RCAG	Radio Channel Record
119	240.0	KKN APP RCAG	Radio Channel Record
120	123.35	SKN APP RCAG	Radio Channel Record
121	123.35	SKN APP RCAG	Radio Channel Record
122	284.0	SKN APP RCAG	Radio Channel Record
123	126.2	UDN APP RCAG	Radio Channel Record
124	126.2	UDN APP RCAG	Radio Channel Record
125	268.5	UDN APP RCAG	Radio Channel Record
126	122.55	LOY APP RCAG	Radio Channel Record
127	122.55	LOY APP RCAG	Radio Channel Record
128	240.0	LOY APP RCAG	Radio Channel Record
129	123.5	UBL APP RCAG	Radio Channel Record
130	123.5	UBL APP RCAG	Radio Channel Record
131	257.8	UBL APP RCAG	Radio Channel Record
132	125.4	ROT APP RCAG	Radio Channel Record
133	125.4	ROT APP RCAG	Radio Channel Record
134	123.6	KRT APP RCAG	Radio Channel Record
135	123.6	KRT APP RCAG	Radio Channel Record
136	119.45	BRM APP RCAG	Radio Channel Record
137	119.45	BRM APP RCAG	Radio Channel Record
138	129.6	SMU APP RCAG (Khaophom)	Radio Channel Record
139	129.6	SMU APP RCAG (Khaophom)	Radio Channel Record
140	305.4	SMU APP RCAG (Khaophom)	Radio Channel Record
141	119.75	NKS APP RCAG	Radio Channel Record
142	119.75	NKS APP RCAG	Radio Channel Record
143	123.35	STN APP RCAG	Radio Channel Record
144	123.35	STN APP RCAG	Radio Channel Record
145	240.0	STN APP RCAG	Radio Channel Record
146	118.6	TRAT APP RCAG	Radio Channel Record
147	118.6	TRAT APP RCAG	Radio Channel Record
148	120.05	CTR APP RCAG	Radio Channel Record
149	120.05	CTR APP RCAG	Radio Channel Record
150	257.8	CTR APP RCAG	Radio Channel Record

Channel	CH Name	Detail	Connect to
151	120.25	NAN APP RCAG	Radio Channel Record
152	120.25	NAN APP RCAG	Radio Channel Record
153	120.1	PAE APP RCAG	Radio Channel Record
154	120.1	PAE APP RCAG	Radio Channel Record
155	126.7	PCB APP RCAG	Radio Channel Record
156	126.7	PCB APP RCAG	Radio Channel Record
157	FIAS Site1	RCAG	Radio Channel Record
158	FIAS Site2	RCAG	Radio Channel Record
159	FIAS Site3	RCAG	Radio Channel Record
160	FIAS Site4	RCAG	Radio Channel Record
161	FIAS Site5	RCAG	Radio Channel Record
162	FIAS Site6	RCAG	Radio Channel Record
163	FIAS Site7	RCAG	Radio Channel Record
164	FIAS Site8	RCAG	Radio Channel Record
165	FIAS Site9	RCAG	Radio Channel Record
166	FIAS Site10	RCAG	Radio Channel Record
167	FIAS Site11	RCAG	Radio Channel Record
168	FIAS Site12	RCAG	Radio Channel Record
169	APP_E1	Area	Record
170	APP_E2	Area	Record
171	APP_S	Area	Record
172	APP_W	Area	Record
173	APP_E1	Area	Record
174	APP_E2	Area	Record
175	APP_E1	Area	Record
176	APP_E2	Area	Record
177	APP_S	Area	Record
178	APP_E1	Area	Record
179	APP_E2	Area	Record
180	APP_N	Area	Record
181	APP_W	Area	Record
182	APP_N	Area	Record
183	APP_S	Area	Record
184	APP_W	Area	Record
185	TEL.Maint1	Area	Record
186	TEL.Maint2	Area	Record
187	TEL.Sector1	Area	Record
188	TEL.Sector2	Area	Record
189	TEL.Sector3	Area	Record
190	TEL.Sector4	Area	Record
191	TEL.Sector5	Area	Record
192	TEL.Sector6	Area	Record
193	2003	Approach	Record
194	2005	Approach	Record
195	2006	Approach	Record
196	2008	Approach	Record
197	9611	Approach	Record
198	9612	Approach	Record
199	9613	Approach	Record
200	9614	Approach	Record
201	Tel. 02-287-3181	Approach	Record

Channel	CH Name	Detail	Connect to
202	Tel. 02-286-0095	Approach	Record
203	Tel. 02-286-0199	Approach	Record
204	Tel. 02-286-0224	Approach	Record
205	Spare1	Spare1	Spare1
206	Spare2	Spare2	Spare2
207	Spare3	Spare3	Spare3
208	Spare4	Spare4	Spare4
209	Spare5	Spare5	Spare5
210	Spare6	Spare6	Spare6
211	Spare7	Spare7	Spare7
212	Spare8	Spare8	Spare8
213	Spare9	Spare9	Spare9
214	Spare10	Spare10	Spare10
215	Spare11	Spare11	Spare11
216	Spare12	Spare12	Spare12
217	Spare13	Spare13	Spare13
218	Spare14	Spare14	Spare14
219	Spare15	Spare15	Spare15
220	Spare16	Spare16	Spare16
221	Spare17	Spare17	Spare17
222	Spare18	Spare18	Spare18
223	Spare19	Spare19	Spare19
224	Spare20	Spare20	Spare20

APPENDIX 3.5.8 : Chiangmai CONTRA Voice Record Channels Capacity**(at least 48 ch/recorder)**

Channel	CH Name	Detail	Remark
1	EC APP 1/TRN 1	Approach	Position Record
2	EC APP 2/TRN 2	Approach	Position Record
3	PC APP 1/TRN 3	Approach	Position Record
4	PC APP 2/TRN 4	Approach	Position Record
5	FDO 1/PSP 1	Approach	Position Record
6	FDO 2/PSP 2	Approach	Position Record
7	FDO 3/PSP 3	Approach	Position Record
8	FDO 4/PSP 4	Approach	Position Record
9	SPARE 1	SPARE 1	Position Record
10	SPARE 2	SPARE 2	Position Record
11	129.600	Approach	Radio Record
12	129.600	Approach	Radio Record
13	305.400	Approach	Radio Record
14	129.600	Approach	Radio Record
15	129.600	Approach	Radio Record
16	305.400	Approach	Radio Record
17	119.300	LPN Approach	Radio Record
18	119.300	LPN Approach	Radio Record
19	120.650	MST Approach	Radio Record
20	120.650	MST Approach	Radio Record
21	126.200	MHS Approach	Radio Record
22	126.200	MHS Approach	Radio Record
23	121.500	All	Radio Record
24	243.000	All	Radio Record
25	BACC S4 (F/R)	Approach	Telephone Record
26	BACC S4 (SAT)	Approach	Telephone Record
27	BACC S7 (F/R)	Approach	Telephone Record
28	BACC S7 (SAT)	Approach	Telephone Record
29	2603 ATS	Approach	Telephone Record
30	2605 ATS	Approach	Telephone Record
31	2611 ATS	Approach	Telephone Record
32	6760 ATS	Approach	Telephone Record
33	57507 RTAF	Approach	Telephone Record
34	57521 RTAF	Approach	Telephone Record
35	02-3034028	Approach	Telephone Record
36	FAN	Approach	Telephone Record
37	4812	Tower	Telephone Record
38	4813	Tower	Telephone Record
39	4817	Tower	Telephone Record
40	4818	Approach	Telephone Record
41	277776	Approach	Telephone Record
42	MET	All	Telephone Record
43	AOT	All	Telephone Record
44	FIRE	All	Telephone Record
45	Spare1	Spare1	Spare1
46	Spare2	Spare2	Spare2
47	Spare3	Spare3	Spare3
48	Spare4	Spare4	Spare4

APPENDIX 3.5.9 : Hatyai CONTRA Voice Record Channels Capacity
(at least 48 ch/recorder)

Channel	CH Name	Detail	Remark
1	EC APP 1/TRN 1	Approach	Position Record
2	EC APP 2/TRN 2	Approach	Position Record
3	PC APP 1/TRN 3	Approach	Position Record
4	PC APP 2/TRN 4	Approach	Position Record
5	FDO 1/PSP 1	Approach	Position Record
6	FDO 2/PSP 2	Approach	Position Record
7	FDO 3/PSP 3	Approach	Position Record
8	FDO 4/PSP 4	Approach	Position Record
9	SPARE 1	SPARE 1	Position Record
10	SPARE 2	SPARE 2	Position Record
11	126.700	Approach	Radio Record
12	126.700	Approach	Radio Record
13	301.500	Approach	Radio Record
14	125.550	NTW Approach	Radio Record
15	125.550	NTW Approach	Radio Record
16	125.550	NTW Approach	Radio Record
17	284.000	NTW Approach	Radio Record
18	125.300	TRN Approach	Radio Record
19	125.300	TRN Approach	Radio Record
20	126.000	PT Approach	Radio Record
21	126.000	PT Approach	Radio Record
22	121.450	All	Radio Record
23	121.500	All	Radio Record
24	243.000	All	Radio Record
25	BACC S5 (F/R)	Approach	Telephone Record
26	BACC S6 (F/R)	Approach	Telephone Record
27	SMU APP	Approach	Telephone Record
28	PUT APP	Approach	Telephone Record
29	KRABI APP	Approach	Telephone Record
30	NTW TWR	Approach	Telephone Record
31	TRN TWR	Approach	Telephone Record
32	PT TWR	Approach	Telephone Record
33	SKL TWR	Approach	Telephone Record
34	BTW	Approach	Telephone Record
35	RONDA1	Approach	Telephone Record
36	RONDA2	Approach	Telephone Record
37	SRT 63523	Approach	Telephone Record
38	MET	Approach	Telephone Record
39	AOT	Approach	Telephone Record
40	TEL. 6812	Tower	Telephone Record
41	TEL. 6817	Approach	Telephone Record
42	TEL. 251-073	All	Telephone Record
43	TEL. 474-570	All	Telephone Record
44	FIRE	All	Telephone Record
45	Spare1	Spare1	Spare1
46	Spare2	Spare2	Spare2
47	Spare3	Spare3	Spare3
48	Spare4	Spare4	Spare4

APPENDIX 3.5.10 : Phuket CONTRA Voice Record Channels Capacity**(at least 48 ch/recorder)**

Channel	CH Name	Detail	Remark
1	EC APP 1/TRN 1	Approach	Position Record
2	EC APP 2/TRN 2	Approach	Position Record
3	PC APP 1/TRN 3	Approach	Position Record
4	PC APP 2/TRN 4	Approach	Position Record
5	FDO 1/PSP 1	Approach	Position Record
6	FDO 2/PSP 2	Approach	Position Record
7	FDO 3/PSP 3	Approach	Position Record
8	FDO 4/PSP 4	Approach	Position Record
9	SPARE 1	SPARE 1	Position Record
10	SPARE 2	SPARE 2	Position Record
11	124.700	Approach	Radio Record
12	124.700	Approach	Radio Record
13	284.000	Approach	Radio Record
14	284.000	Approach	Radio Record
15	120.700	Approach	Radio Record
16	120.700	Approach	Radio Record
17	120.050	KBI Approach	Radio Record
18	120.050	KBI Approach	Radio Record
19	120.050	KBI Approach	Radio Record
20	125.100	RAN Approach	Radio Record
21	125.100	RAN Approach	Radio Record
22	122.450	BACKUP	Radio Record
23	121.500	Emergency	Radio Record
24	243.000	Emergency	Radio Record
25	Briefing	All	Telephone Record
26	BACC S5 (TOT)	Approach	Telephone Record
27	BACC S5 (F/R)	Approach	Telephone Record
28	BACC S6 (TOT)	Approach	Telephone Record
29	BACC S5_KBI (SAT)	Approach	Telephone Record
30	BACC S5_KBI (F/R)	Approach	Telephone Record
31	SMU APP	Approach	Telephone Record
32	HTY APP	Approach	Telephone Record
33	KBI TWR (F/R)	Approach	Telephone Record
34	KBI TWR (SAT)	Approach	Telephone Record
35	RAN TWR (F/R)	Approach	Telephone Record
36	RAN TWR (SAT)	Approach	Telephone Record
37	BGS	Approach	Telephone Record
38	SWALLO	Approach	Telephone Record
39	TEL. 5812	Tower	Telephone Record
40	TEL. 5813	Tower	Telephone Record
41	TEL. 5818	Approach	Telephone Record
42	TEL. 5819	Approach	Telephone Record
43	TEL. 327-195	Tower	Telephone Record
44	FIRE	All	Telephone Record
45	Spare1	Spare1	Spare1
46	Spare2	Spare2	Spare2
47	Spare3	Spare3	Spare3
48	Spare4	Spare4	Spare4

APPENDIX 3.5.11 : Phitsanulok CONTRA Voice Record Channels Capacity**(at least 48 ch/recorder)**

Channel	CH Name	Detail	Remark
1	EC APP 1/TRN 1	Approach	Position Record
2	EC APP 2/TRN 2	Approach	Position Record
3	PC APP 1/TRN 3	Approach	Position Record
4	PC APP 2/TRN 4	Approach	Position Record
5	FDO 1/PSP 1	Approach	Position Record
6	FDO 2/PSP 2	Approach	Position Record
7	FDO 3/PSP 3	Approach	Position Record
8	FDO 4/PSP 4	Approach	Position Record
9	SPARE 1	SPARE 1	Position Record
10	SPARE 2	SPARE 2	Position Record
11	120.700	Approach	Radio Record
12	120.700	Approach	Radio Record
13	284.000	Approach	Radio Record
14	284.000	Approach	Radio Record
15	126.000	TAK Approach	Radio Record
16	126.000	TAK Approach	Radio Record
17	119.450	BACKUP	Radio Record
18	119.450	BACKUP	Radio Record
19	121.500	Emergency	Radio Record
20	121.500	Emergency	Radio Record
21	243.000	Emergency	Radio Record
22	243.000	Emergency	Radio Record
23	132.050	Approach	Radio Record
24	132.050	Approach	Radio Record
25	Briefing	All	Telephone Record
26	BACC S4	Approach	Telephone Record
27	BACC S7	Approach	Telephone Record
28	TAK TWR	Approach	Telephone Record
29	SKT TWR	Approach	Telephone Record
30	CTR APP	Approach	Telephone Record
31	ATS 6709	Approach	Telephone Record
32	ATS 7709	Approach	Telephone Record
33	ATS 7715	Approach	Telephone Record
34	ATS 7010	Approach	Telephone Record
35	ATS 7016	Approach	Telephone Record
36	H//L Dora	Approach	Telephone Record
37	ICS 55988	Approach	Telephone Record
38	TEL. 7000	Approach	Telephone Record
39	TEL. 7015	Approach	Telephone Record
40	TEL. 7016	Approach	Telephone Record
41	TEL. 266-381	Approach	Telephone Record
42	TEL. 301-425	Approach	Telephone Record
43	MET	All	Telephone Record
44	DOA	All	Telephone Record
45	Spare1	Spare1	Spare1
46	Spare2	Spare2	Spare2
47	Spare3	Spare3	Spare3
48	Spare4	Spare4	Spare4

APPENDIX 3.5.12 : Huahin CONTRA Voice Record Channels Capacity
(at least 48 ch/recorder)

Channel	CH Name	Detail	Remark
1	EC APP 1/TRN 1	Approach	Position Record
2	EC APP 2/TRN 2	Approach	Position Record
3	PC APP 1/TRN 3	Approach	Position Record
4	PC APP 2/TRN 4	Approach	Position Record
5	FDO 1/PSP 1	Approach	Position Record
6	FDO 2/PSP 2	Approach	Position Record
7	FDO 3/PSP 3	Approach	Position Record
8	FDO 4/PSP 4	Approach	Position Record
9	SPARE 1	SPARE 1	Position Record
10	SPARE 2	SPARE 2	Position Record
11	126.200	Approach	Radio Record
12	126.200	Approach	Radio Record
13	236.600	Approach	Radio Record
14	236.600	Approach	Radio Record
15	120.500	Area	Radio Record
16	VHF S1 Upper	Area	Radio Record
17	133.000	BACKUP	Radio Record
18	133.000	BACKUP	Radio Record
19	121.500	Emergency	Radio Record
20	121.500	Emergency	Radio Record
21	243.000	Emergency	Radio Record
22	243.000	Emergency	Radio Record
23	132.050	Approach	Radio Record
24	132.050	Approach	Radio Record
25	BACC S1	Approach	Telephone Record
26	SBA	Approach	Telephone Record
27	ATS 2412	Approach	Telephone Record
28	TEL. 5200	Tower	Telephone Record
29	TEL. 5201	Tower	Telephone Record
30	TEL. 5291	Approach	Telephone Record
31	TEL. 5292	Approach	Telephone Record
32	TEL. 5205	All	Telephone Record
33	TEL. 5206	All	Telephone Record
34	TEL. 520-830	All	Telephone Record
35	TEL. 522-097	All	Telephone Record
36	Wing 53	Approach	Telephone Record
37	MET	All	Telephone Record
38	KPS	Approach	Telephone Record
39	BUT	Approach	Telephone Record
40	DOA	All	Telephone Record
41	FIRE	All	Telephone Record
42	B/O	All	Telephone Record
43	Spare1	Spare1	Spare1
44	Spare2	Spare2	Spare2
45	Spare3	Spare3	Spare3
46	Spare4	Spare4	Spare4
47	Spare5	Spare5	Spare5
48	Spare6	Spare6	Spare6